viation Week

and Space Technology

July 3, 1961

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Surveyor Probes Will Seek Clues To Solar Origins

Lightning
batic Team

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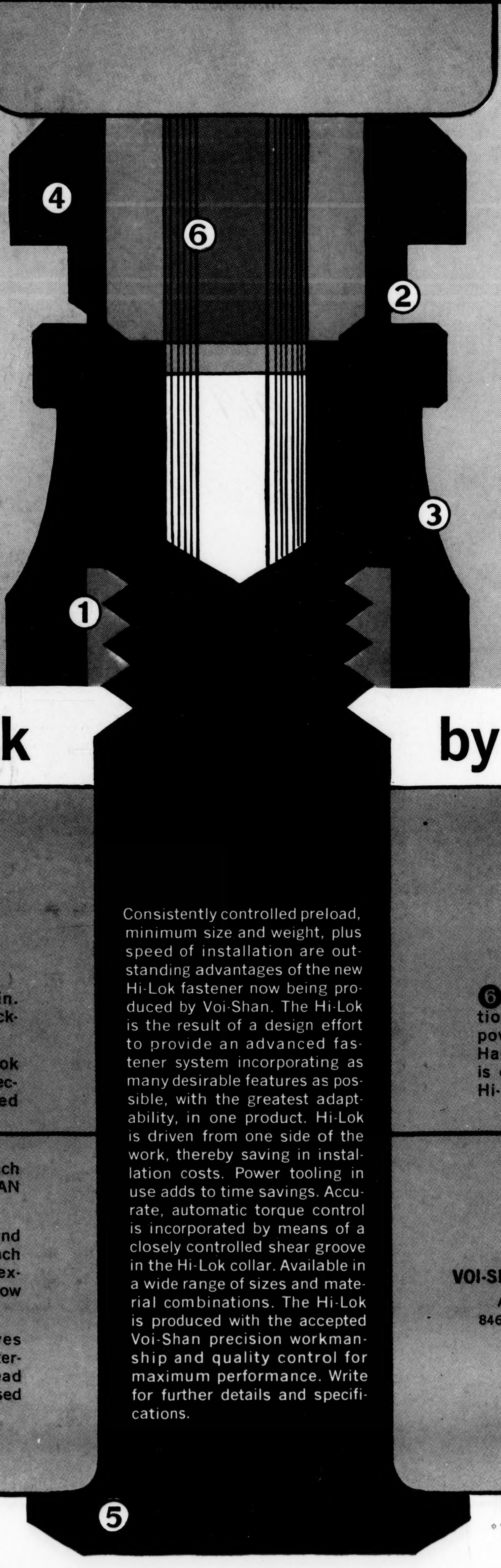

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AVIATION CALENDAR

July 13-16—Third Annual Industry Missile and Space Conference and Aerospace Exposition, Michigan Aeronautics and Space Assn., Cobo Hall, Detroit, Mich.

July 16-21—Fourth International Conference on Bio-Medical Electronics, Institute of Radio Engineers, Waldorf-Astoria, New York, N. Y.

July 17—Air Force Contract Aviation Services Symposium, National Aeronautical Services Assn., Hotel Washington, Washington, D. C.

July 19-21—Summer Meeting, Airlines Electronic Engineering Committee, Aeronautical Radio, Inc., Eden Roc Hotel, Miami Beach, Fla.

July 20-21—Quarterly Regional Meeting, Assn. of Local Transport Airlines, Grove Park Inn, Asheville, N. C.

July 22-24—Annual Meeting, American Assn. of Airport Executives' Northeast Chapter, Wilmington, Del.

July 24-26—Air Traffic Control Facilities Symposium, Electronic Maintenance Engineering Assn., Mayflower Hotel, Washington, D. C.

July 25-Aug. 10—International Trade Fair and Aviation Exhibition, McCormick Place Exposition Center, Chicago, Ill.

July 26-28—Annual Convention, Southeastern Aviation Trades Assn., Deauville Hotel, Miami, Fla.

July 31-Aug. 11—Conference on Physics of the Solar System and Re-entry Dynamics. For information write: Conference Director, Room 310, Holden Hall, Virginia Polytechnic Institute, Blacksburg, Va.

Aug. 1-3—Fourth Western Regional Meeting, American Astronautical Society, Sher-

(*Continued on page 6*)

AVIATION WEEK and Space Technology

July 3, 1961
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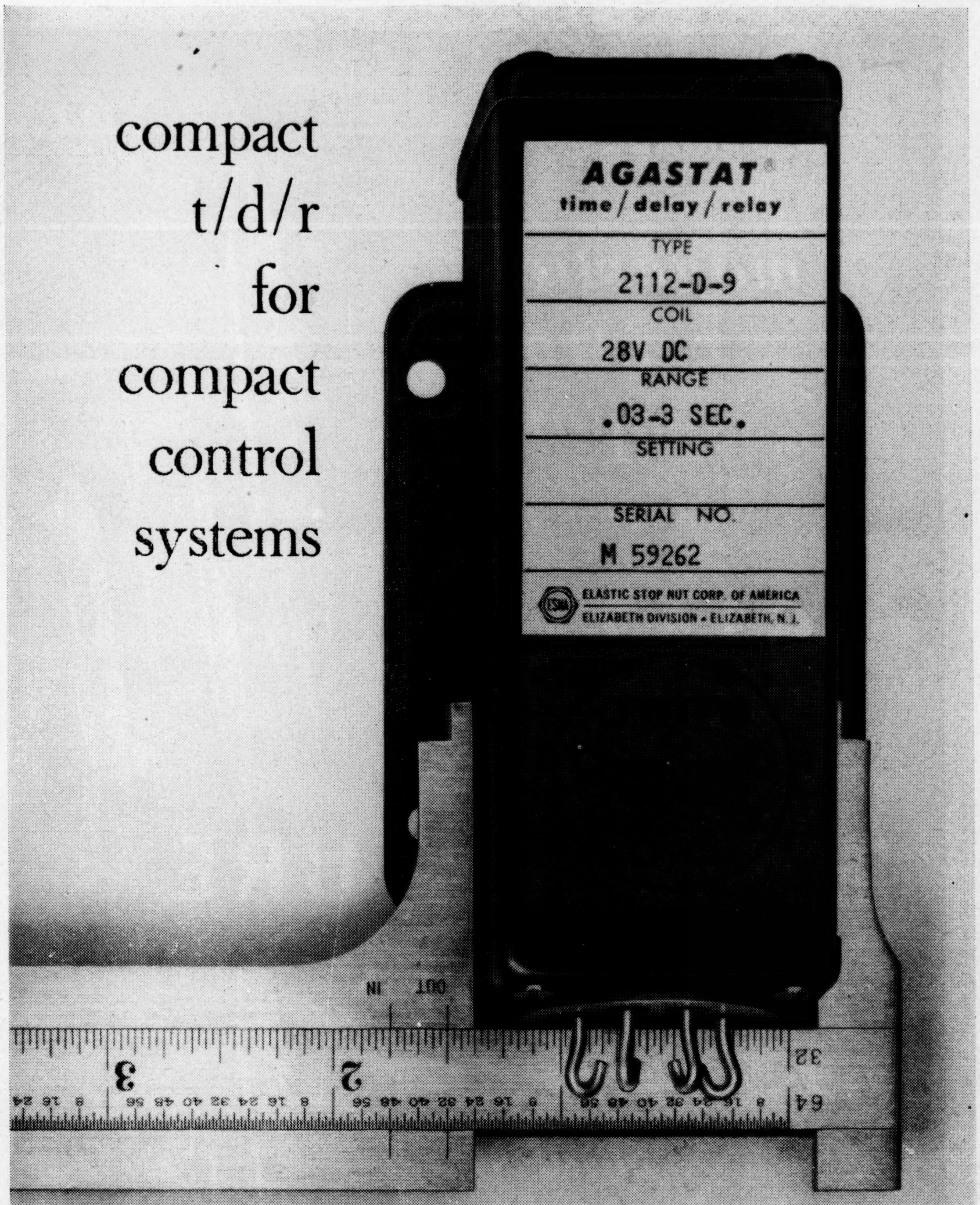

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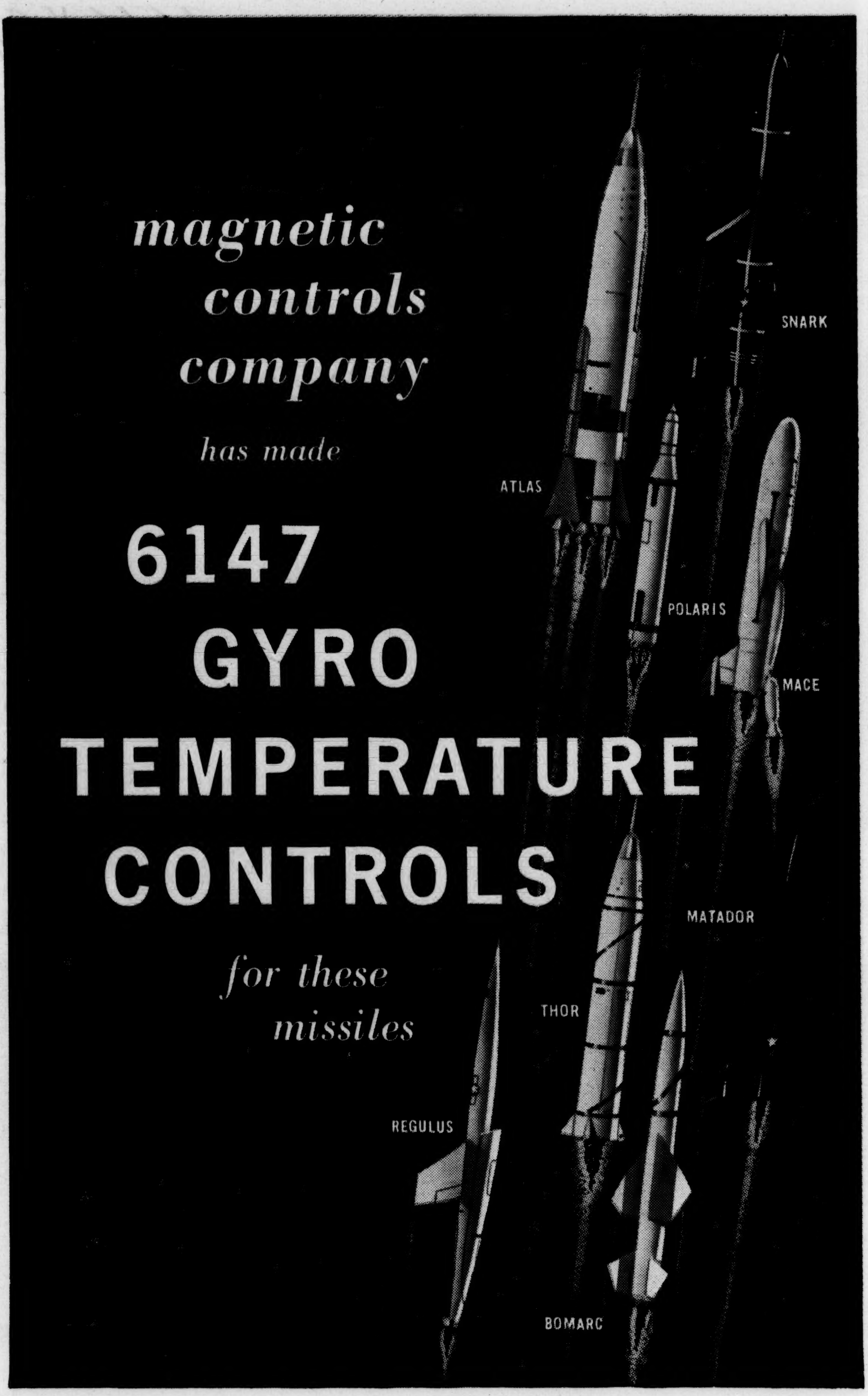

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AVIATION CALENDAR

(*Continued from page 5*)

aton-Palace Hotel, San Francisco, Calif.

Aug. 2-4—Summer Meeting on Aerospace Applications for Hydraulic Fluids Test Methods, American Society for Testing Materials, Santa Ynez Inn, Pacific Palisades, Calif.

Aug. 7-9—Guidance and Navigation Conference, American Rocket Society, Stanford University, Palo Alto, Calif.

Aug. 15-17—Cryogenic Engineering Conference, University of Michigan, Ann Arbor.

Aug. 16-18—International Hypersonics Conference, American Rocket Society, Massachusetts Institute of Technology, Cambridge, Mass.

Aug. 19-24—Institute of the Aerospace Sciences/Naval Aviation Meeting, San Diego, Calif. (Classified.)

Aug. 22-25—Western Electronic Show and Convention, Cow Palace, San Francisco.

Aug. 23-25—Fourth Biennial Gas Dynamics Symposium, American Rocket Society, Northwestern Technological Institute, Evanston, Ill.

Aug. 24-26—Sixth Annual National Reunion, OX5 Club of America, Allis Hotel, Wichita, Kan.

Aug. 30-**Sept.** 1—Third Annual Semiconductor Conference, American Institute of Mining, Metallurgical and Petroleum Engineers, Ambassador Hotel, Los Angeles.

Sept. 4-10—1961 Flying Display and Exhibition, Society of British Aircraft Constructors, Farnborough, England.

Sept. 4-14—Eighth Anglo-American Aeronautical Conference, Royal Aeronautical Society and Institute of the Aerospace Sciences, London, England. Wilbur Wright Memorial Lecture, Sept. 12.

Sept. 6-8—National Symposium on Space Electronics and Telemetry, Institute of Radio Engineers, University of New Mexico, Albuquerque, N. M.

Sept. 10-12—National Convention, National Aeronautic Assn., Westbury, N. Y.

Sept. 13-14—International Operations and Maintenance Symposium, Airwork Corp., Millville, N. J.

Sept. 15-17—Annual Convention, National Assn. of State Aviation Officials, Miami Beach, Fla.

Sept. 20-24—National Convention and Aerospace Panorama, Air Force Assn., Philadelphia, Pa.

Sept. 26-28—Annual Convention, National Business Aircraft Assn., Mayo Hotel, Tulsa, Okla.

Sept. 29-30—Society of Experimental Test Pilots' Fifth Annual Symposium (including a forum on the Supersonic Transport) and Awards Banquet, Beverly-Hilton Hotel, Beverly Hills, Calif.

Oct. 2-7—12th International Astronautical Congress, Washington, D. C.

Oct. 9-15—American Rocket Society's 16th Annual Meeting & Space Flight Report to the Nation, Coliseum, New York, N. Y.

Oct. 14-22—Federation Aeronautique Internationale 1961 General Conference, Hotel Quintandinha, Rio de Janeiro, Brazil.

Oct. 23-24—Joint Meeting, Canadian Aeronautical Institute/Institute of the Aerospace Sciences, Ottawa, Canada.

Oct. 23-27—17th Annual General Meeting, International Air Transport Assn., Sydney, Australia.

July 3, 1961

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COVER: First formation aerobatics by Mach 2 aircraft were performed at the Paris Air Show by pilots of the Royal Air Force No. 74 "Tiger" squadron flying English Electric F.1 Lightnings with full combat armament of two de Havilland Firestreak air-to-air missiles. Nine-plane aerobatic formation of Lightnings demonstrated extremely short turning radius of the aircraft, keeping the demonstration largely within the perimeter of Le Bourget Airport while a single aircraft executed almost "square" turns, kicking in the afterburners of its twin Rolls-Royce Avon turbojets just before starting the turn.

PICTURE CREDITS
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EDITORIAL

Crisis on the North Atlantic

The current financial crisis confronting the North Atlantic carriers provides another sharp focus for the unsolved problems of the jet age, which have the air transport business in serious trouble. The relatively small decline in total passenger traffic flying the Atlantic would not in itself account for the gravity of the problem now facing the North Atlantic carriers. For it is really the enormous, unabsorbed increase in seat capacity afforded by the first year of large-scale jet fleet operations on this route that is the crux of the problem.

The economic recession of the last year would naturally account for some decrease in vacation travel, the backbone of the North Atlantic business. But even with a major upswing in the general economy, which is certainly not yet in sight, the basic elements of the airlines' problems in the jet age will remain.

Certain technical improvements will certainly hone down the operating costs of jet transports, and a thorough overhaul of airline administrative structures is long overdue to cut costs still further. But the basic element, without which any other solution will fall far short of the goal of solidly profitable operations, is the answer to the problem of filling the large quantity of empty seats now being flown in jet transports, not only across the North Atlantic but also on the main domestic routes.

The airlines simply cannot exist in the future on the size of the market they have developed in the past. Simple logic would indicate that the real problem facing the airlines today is to develop new markets that will fill their expanded jet capacity to load factors that will offset rising operating costs and provide the necessary margin for continued profits, which are so desperately needed to stabilize the entire airline picture.

This simple logic has been apparent to many airline people from the days the first cabin diagrams of the jet transports were presented. Unfortunately, there has not been sufficiently widespread recognition of this logic to reorient the airlines' sales philosophy or economics. Basically, the carriers are still competing for a larger individual share of the already existing air travel market, and their major efforts are pitched at switching a customer's allegiance from one house flag to another.

It has been obvious to many airline people that in the jet age, the principal problem of enlarging the air travel market and filling the long rows of six-abreast seats in jet cabins lies in selling the seats for a lower price. Now, lower fares are not a panacea for all airline problems, but they are a vital factor in increasing the trip frequency of current long-haul travelers and they have been successful in the past in generating basically new traffic on the long-haul routes.

It seems to us that the North Atlantic is an ideal place to put this theory to the test if any further testing is needed. Many airline people will agree that it has already been responsible for building both the domestic and international long-haul traffic to its current amazing volume through the steady increase of coach and economy class service.

There are some airlines who have fought valiantly in the past to cut North Atlantic fares to lower levels that would widen the ripples of the air travel market into new economic groups. There also has been a small, hard core of government-supported international carriers who are not really interested in the hard economics of making money in the airline business but simply pass on their losses to their national taxpayers through subsidy requirements.

It is this basic conflict within the framework of the International Air Transport Assn. that has come perilously close to rending its carefully contrived rate setting procedures asunder during the past few years. With the new pressures generated by the financially disastrous summer on the North Atlantic, we predict that the old high fare minority may well be making its last stand at the next IATA traffic conference in 1962.

But lower fares on the North Atlantic will not entirely solve the current crisis on this once highly profitable route. While airline seat capacity has jumped 50% in the past few years, European hotel capacity has been increasing at an almost infinitesimal rate. Pan American World Airways is now building six hotels in Europe to help solve this problem, and the spate of new hotels in Copenhagen now makes it one of the most comfortable gateways through which to enter Europe. But London, Paris and Rome are still acute hotel bottlenecks, and the hinterlands are even worse. It will do the airlines little good to attract a new mass market of European vacationers with low fares if they cannot also guarantee hotel space abroad.

Another inequitable factor in the European air travel picture is the extremely high fares that still prevail on the continent—an obsolete hangover from the old cartel and pooling philosophy that no longer makes any sense in the jet age of enormous seat capacities. Hopefully, during our recent swing around Europe we heard increasing dissatisfaction from the more astute European airline executives with this obsolete high fare structure. We predict more pressure will generate to bring this fare structure more in line with the rest of the world and permit the development of a larger air travel market within Europe.

Another anachronism that no longer has much place in the jet age is the super de luxe first class service that was perhaps the original airline sales pitch in attracting the businessmen and celebrities who were once the nucleus of the airline market. Today, first class service offers so little basic advantage over economy class that the fare discrepancy is too much for even affluent passengers to swallow. As the economy class cabins become more crowded, the first class passengers have a hard time finding company in their isolated elegance.

The current crisis on the North Atlantic should shake the last of the old line, high fare cartelists out of airline management and its international regulatory bodies and permit the hard facts of modern air transport economics to take over. If they don't, U. S. taxpayers, for one, are not going to swallow another subsidy bill, and the international airlines will be in deep trouble.

—Robert Hotz

BURGOYNE IGNORES RECONNAISSANCE AND INVITES DISASTER

General "Gentleman" John Burgoyne was not one to fret over reconnaissance.

Saratoga, frequently called the turning point of the American Revolution, was the end product of a series of "no reconnaissance" battles fatal to Burgoyne's invasion force. Supremely confident as he swung southward from Canada, the British commander rarely knew where or what was ahead. St. Leger's British force, vital element in Burgoyne's campaign, disintegrated when its sizable Indian contingent vanished at news of a huge American counter force. Reconnaissance would have readily shown the Americans mustered a mere 1,000 men. Along his march, Burgoyne dispatched his grenadiers to reinforce a Hessian advance unit at Bennington . . . as usual, without adequate reconnaissance. The grenadiers did not discover until after they were decimated by a Colonial force that the Hessians had already been wiped out. Finally, Burgoyne's confused and weakened men, alone and completely ignorant of enemy forces, surrendered at Saratoga.

Throughout the history of warfare, successful field commanders have based command decisions on proper reconnaissance. Burgoyne ignored history and the obvious need for strategic and battlefield reconnaissance thus committing a series of faulty command decisions and helping to assure the success of the American Revolution.

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WHO'S WHERE

In the Front Office

Dr. Cledo Brunetti, president of Grand Central Rocket Co., will return to Food Machinery and Chemical Corp., San Jose, Calif., as special assistant to the president.

William E. Roberts, president and chief executive officer of Ampex Corp., Redwood City, Calif., succeeding **George I. Long, Jr.**, resigning. Mr. Long will continue as a director.

Edward C. Leeson, vice president and manager, Kidde Aero-Space Division, Walter Kidde & Company, Inc., Belleville, N. J.

Don T. McKone, Jr., executive vice president, Aeroquip Corp., Jackson, Mich.

Paul J. Colleran, vice president-engineering, International Rectifier Corp., El Segundo, Calif.

Benjamin F. Rose, Jr., a vice president, Aerojet-General Corp., Azusa, Calif. Mr. Rose is manager of the company's Aetron Division.

Theodore S. Hoffman, vice president and manager, Semiconductor Division of Hoffman Electronics Corp., Los Angeles, Calif., succeeding **Dr. Morton B. Prince**, now chief scientist and divisional vice president of the Semiconductor Division.

Theodor H. Braun, vice president and director of plans and operations, System Development Corp., Santa Monica, Calif., and **Dr. Launor F. Carter**, vice president and director of research.

William F. Aylard, a vice president, Chase Brass & Copper Co., Waterbury, Conn.

Herman A. Affel, Jr., vice president, Auerbach Electronics Corp., Philadelphia.

Maurice Friedman, a vice president and executive assistant to the president, General Instrument Corp., Newark, N. J.

Louis Kraff, Jr., a director, United Systems Corp., Washington, D. C. Mr. Kraff is manager of the Space Instrumentation Division of Technology Instrument Corp.

Dr. Everard Mott Williams, a director, Electronic Associates, Inc., Long Branch, N. J. Dr. Williams is professor and head of the Department of Electrical Engineering, Carnegie Institute of Technology.

John J. Crowley, vice president of marketing, has been appointed acting general manager of Grand Central.

Rodgers Donaldson, chief counsel, Lockheed Aircraft Corp., Burbank, Calif., and **Robert H. Canan**, assistant chief counsel.

Dale D. Streid, assistant vice president-engineering, Daystrom, Inc., Murray Hill, N. J.

Air Vice-Marshal George Augustus Walker, air officer commander-in-chief, Royal Air Force Flying Training Command, succeeding **Air Marshal Sir Hugh Constantine**, now commandant of the Imperial Defence College.

Dr. Bruce A. Reese, deputy chief of the Anti-Missile Missile and Space Defense Projects office of the Army Rocket and Guided Missile Agency, Redstone Arsenal, Ala.

Dr. George R. Steinkamp, deputy civil air surgeon of the Federal Aviation Agency's Bureau of Aviation Medicine.

(*Continued on page 82*)

INDUSTRY OBSERVER

▶ Air Force Lockheed U-2s with infrared equipment are flying picket missions off the coast of the Soviet Union. Based in Alaska, the high-altitude aircraft provide an aerial IR detection capability similar to the warning function the Midas satellite will perform when it is operational.

▶ General Electric J93 turbojet, under development for the North American B-70, is scheduled to start its 50-hr. test at Evendale, Ohio, within two weeks, following several satisfactory unofficial trials.

▶ Boeing is considering adaption of proven Project Mercury life support system components for the Dyna-Soar drop test vehicle, which will be used to check out some aerodynamic characteristics of the hypersonic glider.

▶ Lockheed is developing a wingtip VTOL package incorporating 14 vertical jets. An integral fuel supply will permit relatively high thrust for 3 min., which normally would be divided equally between takeoff and landing periods. Reportedly about the size of an F-104 tip tank, the VTOL package conceivably could be adapted to stretch the capability of this or other aircraft.

▶ Royal Australian Air Force has shown interest in the British Aircraft Corp. TSR-2 supersonic strike-reconnaissance aircraft to replace its Dassault Mirage III in 1967-68. BAC recently made a TSR-2 presentation to top RAAF officers in London, and has made a similar presentation to the U. S. Air Force. The aircraft is due to fly in 1963 and will be powered by two Bristol Siddeley Olympus turbojets of about 33,000 lb. thrust each.

▶ Watch for the West German Defense Ministry to have its recently ordered 90 Sikorsky S-58 helicopters converted to turbine power after delivery to Europe. French Turbomeca engines will replace the S-58's Wright R1820 piston engines. Turbomeca conversion is part of the package agreement arrived at during top-level political discussions, when the Germans also agreed to order the Sud 3210 Super Frelon for long-range, heavy-turbine helicopter requirements (AW June 19, p. 34). S-58 order is to fill the gap until delivery of the 150 Super Frelons begins in the mid-1960s.

▶ Wing molds for the all-plastic Piper PA-29 Papoose have been completed at the company's Vero Beach, Fla., plant, and first flight of the prototype is expected in 4-5 months. The low-wing, two-place aircraft, powered by a 65-90 hp. engine (AW Dec. 26, p. 13), is to go into production if tests prove the feasibility of glass fiber construction.

▶ Astronomical satellite concepts developed by the Royal Aircraft Establishment for the British Aviation Ministry involve a reference platform with six or more telescopes aimed at certain stars and an astronomical telescope attached to the stable platform by a two-axis mount. Elliott Bros. is studying altitude control. Orbit altitude would be 300 mi., period 90 min.

▶ Air Force expects the flyaway cost for the Lockheed C-130E to drop from $2.3 million in Fiscal 1961 to $1.3 million in Fiscal 1962. Firm airframe price negotiated for purchase of 16 aircraft in Fiscal 1961 is $1,765,000. USAF plans to buy 83 in Fiscal 1962, and peak production rate of eight aircraft per month is scheduled to be reached in April, 1963.

▶ Modification of Complex 16 at Cape Canaveral to handle launching of the USAF Martin Titan II is nearing completion and a ground checkout model of the missile will be shipped there soon. First launching of a Titan II is not expected before late fall.

▶ Estimated unit cost of the Hound Dog missile currently is $534,000, but Air Force expects to reduce this to $519,000 in Fiscal 1962.

▶ Navy will bail two ZPG-2 airships to Goodyear Aircraft, one for Project Clinker airborne infrared detection experiments and the other for airborne wind tunnel studies. The move follows abolishment of Navy lighter-than-air program.

Raytheon Fire Control Radar System installed in newest missile destroyer

Raytheon AN/SPG-51 fire control radars are operational aboard the U.S.S. CHARLES F. ADAMS (DDG-2). As the Mark 74 Fire Control Systems Coordinator for the Bureau of Naval Weapons, Raytheon is carrying out serial production of the advanced design AN/SPG-51.

The ADAMS, first destroyer built from the keel up to launch guided missiles, carries out its Anti-Air Warfare mission with TARTAR surface-to-air missiles. The radar tracks intruders and guides the missile even to low altitude targets despite the use of evasive tactics or electronic countermeasures.

Each AN/SPG-51 consists of a single dish tracking and guidance radar. The radar tracks at long ranges with exceptionally low power.

Upon assignment, AN/SPG-51 automatically acquires and tracks the target. Seconds before missile launch, the target is illuminated with a guidance beam. The missile homes on the reflected signal.

The AN/SPG-51 features excellent sub-clutter visibility and exceptional techniques to resist jamming. Selected by the Bureau of Naval Weapons for guided missile applications, this is the first fire control radar of its type to be procured in quantity.

RAYTHEON

RAYTHEON COMPANY

EQUIPMENT DIVISION

Washington Roundup

Snap Decision

White House has reversed its recent ruling prohibiting the flight testing of nuclear auxiliary power packages in satellites. State Department has been concerned for some time about the political implications of orbiting power units or propulsion units such as the Nerva nuclear rocket engine.

The space task group named earlier this year by President Kennedy and headed by his science adviser, Dr. Jerome B. Wiesner, said the use of nuclear rockets would "raise serious international political problems since the possibility that a reactor could re-enter and fall on foreign territory cannot be ignored."

Navy's Transit IV-A experimental navigation satellite was to have carried a Snap radioisotope power generator into orbit last June 6, but the nuclear package was eliminated from flight plans shortly before launch on orders from the White House. The launching was scrubbed—apparently for other reasons, since a standard power source was available as a backup.

Toughening attitudes of the U. S. and the Soviet Union toward each other in recent weeks may have influenced the latest shift, but whatever the reasons, the White House reversed its stand and approved the Snap test in the Transit launch last week.

Anglo-American negotiations on defense research and development specifically exclude cooperation on any of the 20 current NATO weapons development programs in which a U. S.-U. K. combination would be strongly resented by the competing European nations.

These technical cooperation discussions between Assistant Secretary of Defense John Rubel and Solly Zuckerman, chief scientific adviser to British Defense Minister Harold Watkinson, are an implementation of earlier talks between Watkinson and Defense Secretary Robert S. McNamara and are still on an extremely general level. No specific agreements have been reached yet, according to McNamara.

Presidential Insulation

President Kennedy's appointment of Army Gen. Maxwell D. Taylor as his military representative (see p. 31) has brought a rash of criticism aimed at the method rather than the man. Some Pentagon observers say this simply adds another layer between the chiefs of the military services and their commander-in-chief. They also believe the new arrangement will be used by the White House to bypass Army Gen. Lyman Lemnitzer, chairman of the Joint Chiefs of Staff, on some questions.

Debate over the appointment—which needs no congressional approval—split along party lines in the House of Representatives. Rep. John McCormack, majority leader, defended it. Rep. Leslie Arends, ranking Republican on the Armed Services Committee, led the critics, who praised Gen. Taylor but said his known views differ from those of the joint chiefs, that law establishes the chiefs as military advisers to the President, and that naming a special adviser is a back door approach to a single chief of staff.

Submariners, who are playing an increasingly important role in the Navy's deterrent and defensive capabilities, are resentful that they are not represented in either of the two top Navy jobs. Traditionally, either the chief of naval operations or the vice chief is an aviator. Even surface ship officers are not too happy over the selection of Vice Adm. George Anderson as chief and Vice Adm. Claude V. Ricketts (see p. 31) as vice chief, since Adm. Anderson is a flyer and Adm. Ricketts began his career as one. But the appointment of Adm. Ricketts reflects the Administration's emphasis on limited war. He is a specialist in amphibious operations.

Mitchel Controversy

Federal Aviation Administrator Najeeb Halaby has moved directly into the controversy over what should be done with Mitchel AFB on Long Island after the U.S government moves out. He urged New York's Gov. Nelson Rockefeller to reserve about half the 1,200-acre field for a general aviation airport. Rockefeller has been noncommittal, so Halaby has sent his lawyers looking for a way to force the issue. They have decided there is enough authority to make creation of an airport a prerequisite for getting the property.

One hitch is that a public body—not a private group—must ask the government for use of the land as an airport. Several groups already are vying for the base. One of the organizations fighting against an airport is headed by Robert Moses, the outspoken chairman of the Long Island Park Commission. But Halaby, no stranger to turbulent flying, is going ahead with his campaign.

FAA's National Aviation Facilities Experimental Center (NAFEC) is coming under increasing fire from FAA contractors for its slowness in testing and evaluating new equipment. But contractors have long experienced similar delays at military test centers, so the situation is not exclusive with FAA. Ironically, Air Force has been growing more impatient with FAA, claiming its evaluations of military equipment were brief but not thorough enough (AW May 22, p. 21).

—Washington Staff

House Votes Bomber, Dyna-Soar Increase

Hypersonic glider budget boosted to $185.8 million; $448.8 million appropriated for long-range bombers.

By Katherine Johnsen

Washington—Two major increases in Fiscal 1962 defense funds—for Strategic Air Command long-range bombers and the Dyna-Soar manned space vehicle—were unanimously voted by the House last week.

The defense appropriations measure, now pending before the Senate, specifies $185.8 million "only for the Dyna-Soar program," and provides that "not less than" $448.8 million "shall be available only for the procurement of long-range bombers." The Administration requested $100 million for Dyna-Soar and no funds for SAC bombers. These were the only major House changes in the Administration's defense budget.

The additional Dyna-Soar funds would implement Project Streamline under which achievement of manned orbital flight would be accelerated by three years and the total cost of the program reduced by approximately $300 million.

Foreseeing a military requirement for a manned space vehicle, House Appropriations Committee, in its report accompanying the military appropriation legislation, commented that "the Dyna-Soar concept provides the quickest and best means of attaining this objective.

Space Boldness Lacking

"One criticism often made regarding our space programs is that they lack the boldness and imagination required to achieve objectives within a sufficiently short time to attain for the U. S. the primary position in space conquest." The report added that Dyna-Soar planning to date "has lacked boldness and imagination" and that "unnecessarily complex component development requirements have slowed the pace. . . ."

Congress already has "authorized" $525 million for Fiscal 1962 long-range bomber procurement, plus $220 million for the Air Force North American B-70 program. The authorization represents the maximum amounts that may be followed with implementing appropriations.

The House appropriations group gave "first preference" in the use of bomber funds to the B-70 program, but added that "it is not meant by this recommendation that the Defense Department should be prohibited from utilizing the funds provided in the long-range bomber account, for other long-range bombers"—Boeing B-52s or Convair B-58s.

The committee went so far as to suggest that, in addition to the $448 million, Defense might divert Fiscal 1962 funds earmarked for other programs to bomber procurement "in the event such a course is determined to be wise."

Unless there are additional orders during Fiscal 1962, the production lines of the B-52 and B-58 are scheduled to close in September, 1962. Modifications on the B-52 would keep the Boeing plant at Wichita, Kan., in operation for several months beyond this date.

The appropriations group commented that "it may not be wise to go as far as the Department of Defense has proposed in discontinuing, during calendar year 1962, production of the B-52 and B-58 bombers, while at the same time restricting the development of other manned bombers, especially the B-70" The committee noted that "for the first time in a quarter of a century the budget proposed that the Air Force not buy production quantities of a bomber aircraft . . . ."

The total $42.7 billion in defense appropriations approved by the House was $2.4 billion more than the Fiscal 1961 appropriation and a net $6.2 million less than the Administration request.

The total allocated was: Air Force, $17.6 billion; Navy, $13.4 billion; Army, $10.4 billion; Office of the Secretary of Defense, $1.3 billion.

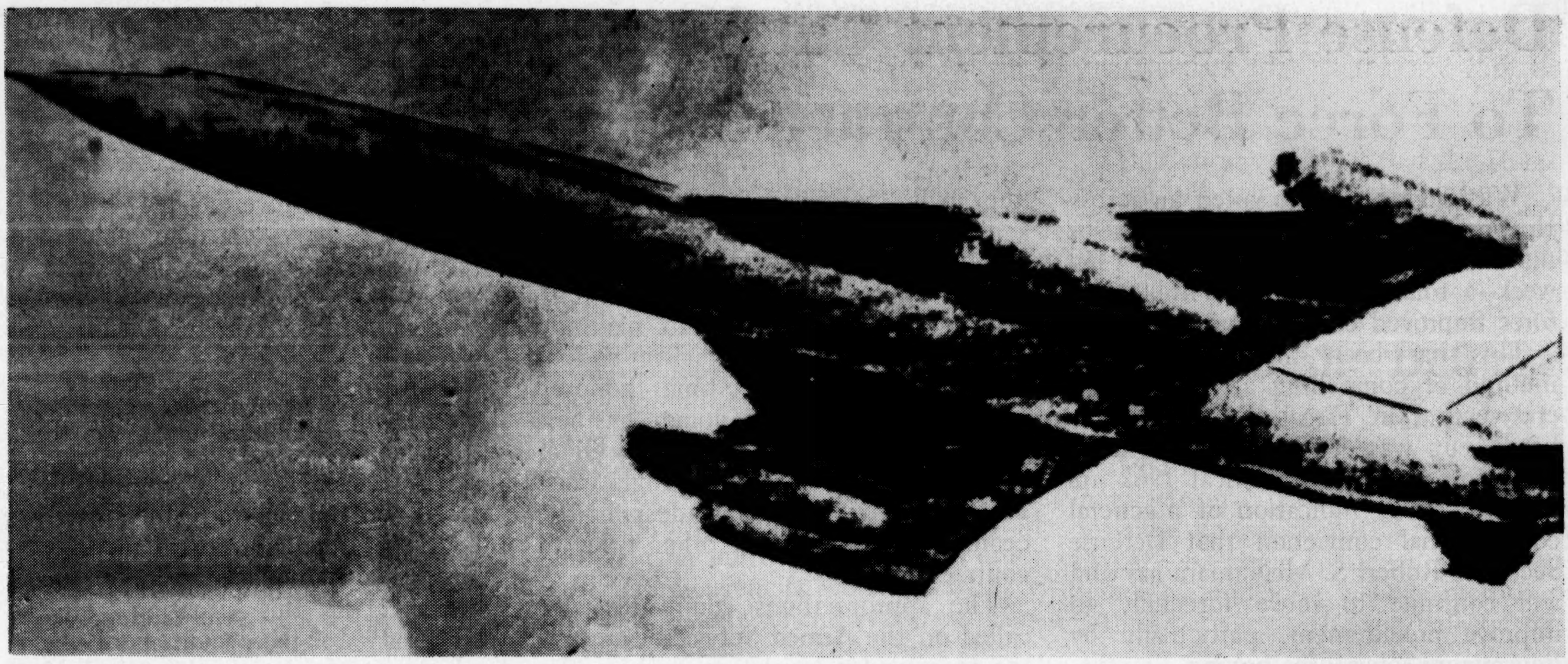
The committee's judgment was that U. S. military strength continues to be superior to that of Russia and that the Fiscal 1962 budget is adequate to maintain this superiority.

Atlas E Fails

Washington—Failure of a USAF-Convair Atlas E at Cape Canaveral on June 22 was the seventh in the 10 launchings of E models attempted so far. No pattern of causes for the failures has developed. Nine, including the June 22 shot, were fired from the Air Force Missile Test Center in Florida and one from Vandenberg AFB, Calif.

The House approved these Appropriations Committee moves:

- **Lockheed T-40.** $19.1 million for 10 of the utility support aircraft was eliminated. The Appropriations Committee severely criticized Air Force and Navy for failing to work out a common program for replacement of hundreds of obsolescent C-47 and C-54 aircraft for logistic support (AW June 19 p. 29). The committee declared that no utility aircraft procurement will be approved "until a realistic long-range plan has been worked out for the entire Department of Defense requirement."
- **Polaris fleet ballistic missile** program. Defense Department was urged by the Appropriations Committee to announce a plan for continuation of the program beyond the 29 submarines now authorized. It expressed concern that there would be a gap unless orders are placed for long leadtime items for additional submarines this fall.
- **Mobile Minuteman.** The committee expressed "reservations over the decision to slow up or curtail the development of a mobile capability" for the solid propellant intercontinental ballistic missile. No funds were requested in the Fiscal 1962 budget to develop the mobile capability, meaning the Fiscal 1961 funds would have to be stretched over two years.
- **Nike Zeus.** The committee, which in past years has recommended funds for the anti-missile missile in excess of Administration requests, said that it now "feels that much work in testing and proving out remains to be accomplished before a sound decision can be made to commit the Nike Zeus to production and deployment."
- **Small war weapons.** Applauding the increasing emphasis being placed on weapons for limited and "sub-limited" war, the committee anticipated that "after further study Department of Defense will want to do even more toward preparing for such warfare."
- **MATS procurement.** The legislation passed by the House last week earmarks $80 million for procurement of commercial air transportation by Military Air Transport Service.
- **Basic research.** Modest reductions were made in the basic research programs of all three services to slow the rapid expansion of activities in this area. "It is felt that basic research programs should be funded on a reasonably level basis," the Appropriations Committee commented. "It is rather difficult to expand rapidly such programs and be sure that the funds are applied where most urgently needed."



NEW RUSSIAN heavy bomber—NATO code-name Bounder—is shown flying over Moscow last week in the first officially released Russian picture. Note striking similarity with copyright drawing published by Aviation Week Dec. 1, 1958, p. 26, depicting this design as a prototype flying testbed for Soviet airborne nuclear powerplants.

Soviet Union Displays Supersonic Bomber

Moscow—Red Air Force plans to display at least two types of supersonic bomber, a new jet flying boat, a new design medium bomber with rear fuselage-mounted jets, a flying crane helicopter, jet-powered STOL aircraft and several new large transport helicopter types at the July 9 air show, now scheduled for the Tushino airdrome at the edge of Moscow.

The new types have either been identified in the massive flyby rehearsals that have been roaring over Moscow for several weeks (AW June 19 p. 29) or have been listed in Soviet newspapers detailing the program for the show.

Soviets officially released pictures of the Delta-winged Bounder last week after western observers had identified it flying in the air show rehearsals for several weeks. The Bounder flying over Moscow is almost identical to the exclusive drawing of a Soviet bomber published in Aviation Week Dec. 1, 1958, p. 26, and identified at that time as the prototype testbed for a nuclear-powered bomber.

The Bounder has since been identified in several different versions, indicating a heavy development program since it first flew in mid-1958. The version now flying over Moscow has a rounder fuselage than the earlier prototypes, and all protruding radomes and other fuselage projections have been removed in what is obviously a drag reduction modification.

The extremely large nacelles contain two pylon mounted engines that are much larger than the two engines mounted at the tips of the delta wing. The rear section of the fuselage also appears to be shorter than the original prototype was during its early days at the Soviet experimental test center at Ramenskoye, southeast of Moscow. There were no indications whether the version of the Bounder in the Moscow flybys was nuclear-powered.

Western observers also have identified a jet-powered flying boat and a new design medium bomber with rear-fuselage-mounted turbojets similar to the powerplant installation on the French Caravelle jet transport. Formations of turboprop-powered Bear bombers (military version of the Tu-114 transport) have appeared in the flyby equipped with air-to-ground missiles similar to the Martin Bullpup. First casualty of the rehearsals occurred last week when a MiG-19 (Farmer) stalled out during high speed formation acrobatics and crashed, killing the pilot.

Moscow newspaper Trud confirmed that the delta-winged Bounder would appear and identified it as a "supersonic delta-wing bomber." Trud said the Bounder would be followed by "supersonic heavy bombers escorted by fighters," indicating that at least two types of supersonic bomber will be displayed. The other supersonic bomber is believed to be the NATO code-named Blinder with a top speed just under Mach 2.

Trud also said formations of "silver battle planes with air-to-ground rockets under their bodies" would be displayed, and Pravda emphasized that the rocket-armed bombers are an important addition to Red Air Force power.

The Moscow newspaper also reported that a new type STOL aircraft would be shown "combining features of the helicopter and airplane, utilizing both rotor and fixed wing." This STOL aircraft is powered by two turbine engines which drive both the rotor installation and conventional propellers.

Practice flybys also have indicated that several large transport helicopter types will be shown. The two latest Aeroflot transports—the Tupolev Tu-124 twin-turbofan feederliner and the Antonov An-24 twin-turboprop bushliner—have also been identified.

Gen Sergei Rudenko, deputy commander in chief of the Red Air Force and chief of the Tushino show, said in a Tass interview last week that the July 9 display is aimed at "demonstrating the might of Soviet aviation." This confirms Western speculation that the sudden revival of this event, which has been dormant since 1956, was caused by the impressions of Soviet aviation weakness left by the lack of participation in the Paris International Air Show last month (AW June 12 p. 21). It also serves as a propaganda backdrop for the growing Soviet pressure on the West over Berlin.

Late last week, there was no indication that the Soviets would invite the chiefs of Western air forces, including the U. S. Air Force, to Moscow for the Tushino show as they did in 1956. Soviet air shows conducted since the massive military flyby over Tushino in 1956, at which seven new types of jet aircraft were displayed for the first time, have consisted only of sports airplanes, gliders, transports and civil-type helicopters. They have all had a heavily emphasized "peaceful" theme.

Defense Procurement Cut Voted To Force Better Contract Pricing

Washington—House voted an across-the-board 2% cut in all Fiscal 1962 military procurement categories last week—a total of over $308 million—to force improved contract pricing.

This has been the Congressional method of compelling action for several years. The Fiscal 1961 across-the-board cut was 3%, and the smaller reduction proposed for Fiscal 1962 appears to be an indication of a general congressional conviction that Defense Secretary Robert S. McNamara has and will continue to move forcefully to improve procurement, particularly by minimizing sole-source buying.

The House also passed without discussion a ban on the use of defense contract funds for advertising, which said: "No part of the funds appropriated herein shall be available for paying the costs of advertising by any defense contractors, and such costs shall not be considered a part of any defense contract cost." This resulted from testimony before the defense appropriations subcommittee, chiefly from Navy's Vice Adm. Hyman Rickover, that was highly critical of the use of defense funds for advertising and of the amount of information disclosed in ads.

Reporting the military appropriations bill, including the 2% cut, to the House, the House appropriations committee commented: "It is believed that efforts toward continued improvement will be pursued vigorously by the new secretary of defense."

In his presentation to the group, McNamara volunteered that there is widespread waste and considered its solution "a ten-year job." He told the committee that "we are endeavoring to attack waste on all fronts, starting with the requirements, working right through the procurement process to insure that we buy at the lowest possible price and through to the actual utilization of the items after we have purchased them."

McNamara observed that his department will make use of criticisms by General Accounting Office and congressional committees instead of trying to "refute" them. He has asked GAO to expand its activities.

The committee called for a report by McNamara in January, 1962 "showing what action has been taken to increase formally advertised bidding and competition in defense procurement."

The committee also notified the assistant secretaries for supply and logistics of the three services, responsible for implementation of Defense Department procurement policies, that they will "be called upon periodically . . . for a proper and detailed accounting of their stewardship . . ."

The military departments were criticized for an inclination to maintain "the status quo" in contracting and "a reluctance to change time honored ways and means of doing business whereby certain contractors as well as certain public facilities seemingly must be maintained in being despite the economic advantages of other types of contracting."

The appropriations committee also called on the Armed Services Committee to consider legislation curbing the use of nonprofit organizations by the services for technical management, scientific evaluations and administrative and management services which "is increasing at a rapid rate." The committee viewed the use of such organizations "to a considerable extent" as "merely a subterfuge to avoid the restrictions of civil service salary scales."

Cutting the $35.2 million Fiscal 1962 budget request for Aerospace Corp.—USAF's technical manager for missile and space programs—by $5 million, the appropriations group said it believes that "the salaries paid by the Aerospace Corp. are excessive, that its overhead costs are too high, and that it plans to employ too large a staff."

Rep. Chet Holifield (D.-Calif.), chairman of the Joint Congressional Atomic Energy Committee, and Rep. Paul Kilday (D.-Tex.), high ranking Armed Services Committee member, vigorously defended Aerospace in speeches on the floor. Rep. Kilday argued that disruption of Aerospace's operations could have a serious and far-reaching effect on the U.S. technological position. Rep. Holifield noted that salaries of the executives of large aerospace companies are far in excess of those received by Aerospace's management.

Highlights of Defense's program for improvement of procurement, presented to the committee by Thomas D. Morris, assistant secretary for supply and logistics, were:

- **What to buy.** To help assure wisdom on the initial decision—what to buy—Defense is perfecting a "master urgency list" for guidance, Morris reported.
- **How to buy.** Noting that a key weakness is that "we do not move early enough to convert single-source buying to some form of competition," Morris pointed out that McNamara has directed a memorandum to all procurement officials to place major emphasis on correcting this situation. He reported 60% of the procurement placed under contract during the first half of Fiscal 1961 was non-competitive.
- **Improved statistics.** In order to readily spot areas of non-competitive buying, Morris said Defense statistics will pinpoint whether an award was made on a technical or price basis and whether it was a competitive award. He said Defense is also expanding its list of proposed awards for negotiated contracting published by the Commerce Department.
- **Unified training.** A unified program of training for all Defense procurement officials will be started shortly, Morris said. Until now, the services have conducted separate programs.
- **Value improvement.** The department is moving in two directions to improve value received for dollar spent, according to Morris. First, "major studies" are under way to achieve a "practical and acceptable system of rewards and penalties" under cost reimbursable type contracts, which have increased from 13% of total procurement in Fiscal 1951 to 42% in Fiscal 1960. He said Defense also is working to eliminate "expensive and sometimes questionable characteristics called for in our specifications" and intends to expand the use of contract provisions under which contractors will share in part of the savings that come from their suggestions for specification revisions.
- **Weapon reliability.** One area "in which we have substantial catching up to do" is in the improvement of electronics specifications for greater equipment reliability, Morris reported. He said Defense plans "to express reliability requirements in precise mathematical, statistical, and engineering terms, and to prescribe sampling and test procedures, instrumentation and other criteria needed to measure conformance." One objective is to incorporate reward incentives in contracts for manufacturers who achieve high reliability.

USAF Management Shift

Washington—Air Force's Electronic Systems Division, with the assistance of The Mitre Corporation, will assume system engineering management responsibilities for future electronic support systems instead of giving such authority to industry prime contractor, Dr. Brockway McMillan, assistant Air Force secretary for research and development, told the Military Electronics Convention here last week. First program to be handled on this basis will be the new underground Norad Combat Operations Center (425-L).

Senate Authorizes NASA Budget Requested by President Kennedy

Washington—President Kennedy's accelerated space program passed its first test in Congress last week when the Senate voted to authorize all the Fiscal 1962 funds he requested for the National Aeronautics and Space Administration.

The full $1,784,300,000 the President asked for NASA was authorized, and only relatively minor amendments were added to the Administration bill.

Chairman Robert S. Kerr (D.-Okla.), of the Senate Aeronautical and Space Sciences Committee said the bill "will provide funds needed to develop, on an efficient basis, not only the manned moon exploration project, but also the fastest, economically feasible development of communications and weather forecasting satellites, plus the development of numerous other space resources with profound long-range benefits to our national economy and security and health.

Support Expected

"I am convinced," Sen. Kerr added, "that the people will support the investments needed to insure continuation of this nation's over-all lead in the scientific programs under the jurisdiction of NASA—programs conducted in full view of not only the people of this nation, but of the world. Public understanding and acceptance of this national mission are absolutely essential to the realization of our long-range goals."

The Senate bill authorizes $1,295,539,000 for NASA research and development, $262,075,000 for construction of facilities, and $226,686,000 for salaries and expenses.

Before reporting the bill, the Senate space committee amended it to permit the NASA administrator to divert up to $50 million of agency funds into emergency building projects without prior approval of Congress. He could also transfer up to $20 million to other government agencies working on space projects. Both amendments were approved in advance by the White House, the committee said.

Programs Compared

The $1.78-billion program authorized by the Senate compares with $1.36 billion authorized by the House May 24—the day before President Kennedy requested additional space funds. However, the House in its NASA appropriations bill—the legislation which actually provides the money—voted $1.2 billion, $35,300,000 less than President Kennedy asked for in his first review of the Eisenhower Administration space budget, and $161,900,000 less than in the House authorization bill.

The Senate committee added the requested space money to the House-passed authorization bill. Now the amended measure returns to the House Science and Astronautics Committee.

The committee can conduct special hearings on the President's money requests or ask for a conference with the Senate to work out differences in the two bills.

Another possibility is that the House-passed bill will be amended directly to conform to the Senate version by a vote on the House floor rather than through a conference.

NASA Considers Major Reorganization

Washington—Substantial reorganization of the National Aeronautics and Space Administration is under consideration to manage the vastly expanded civilian space program, but no formal action will be taken until Congress approves the agency's new budget.

NASA is studying a variety of plans to provide management for its increased program, including consolidation of several program offices into three major line divisions: Manned Space Flight, Unmanned Space Flight, and Advanced Research and Development.

This organization would put life sciences functions and a portion of the launch vehicles programs under Manned Space Flight. Also under consideration is consolidation of the technical information and education office with public information into a single information office.

Rep. James G. Fulton (R.-Pa.), a member of the House space committee, and Trevor Gardner, Hycon Manufacturing Co. president (see p. 52), have suggested use of well-known systems management teams—such as those which ran the nuclear submarine, ballistic missile and Polaris programs—for the manned space flight program, but the agency feels it is premature to commit itself to selection of management personnel or a management concept until Congress establishes the extent of the program.

NASA is seriously considering a "super" management organization to integrate the spacecraft and launch vehicle developments in the Apollo manned lunar landing program, but like the new management structure, this organization is tentative. It is expected that the Space Task Group will manage development of the Apollo spacecraft, and Marshall Space Flight Center will manage the Nova launch vehicle contracts.

Arpat Missile Defense Could Follow Nike Zeus

Advanced Research Projects Agency's new terminal defense against ballistic missiles, known as ARPA Terminal or Arpat, is being designed as a less expensive and more reliable method of killing barrages of hostile ballistic missiles in their terminal phase than the Army's Nike Zeus anti-ICBM program.

The Arpat approach is considered an extension of Zeus and ultimately may be incorporated into it. A team consisting of Raytheon, Hughes Aircraft, International Business Machines and Boeing recently was selected by ARPA to handle research and development for the project (AW June 19, p. 23), which is to be managed by the Army Rocket and Guided Missile Agency.

Arpat will have its prime value in anticipated situations where an entire front of warheads and decoys, perhaps many miles in width and many more miles in depth, is re-entering the earth's atmosphere. This situation, with its manifold problems of decoy discrimination, target acquisition and multiplicity of targets, might overburden Zeus.

To counter such a threat, ARPA, its Institute for Defense Analyses and almost a dozen study contractors (AW Apr. 10, p. 26) worked out details of the Arpat concept. It would involve boosting a carrier, or lofter, into the atmosphere as the hostile wavefront approached target. Somewhere between 20,000 and 100,000 ft.—below the incoming warhead barrage—retrorockets would be fired to halt the boost of the carrier long enough for it to remain stationary for a fraction of a second.

At this point, several dozen small homing interceptors, or darts, taken aloft in the carrier, could be fired simultaneously or stagger-fired. Each homing interceptor would have a small booster of its own and be capable of covering a range of several miles from the airborne launch point. The interceptors, are to contain infrared or ultraviolet target seekers.

The carrier, or lofter, portion of ARPA's current contract on Arpat will be made by Boeing. Hughes Aircraft has responsibility for developing and flight testing the homing interceptor. Raytheon will be responsible for general acquisition and discrimination radar.

European 10-yr. Space Program Proposed

London—Ten-year program which would put western European nations in the space business would cost about $140 million a year, with the payoff ranging from communication satellites to manned re-entry flight.

Proposal was outlined to delegates at the European Symposium on Space Technology here, sponsored by the British Interplanetary Society, by L. R. Shepherd, director, Research and Development Division, United Kingdom Atomic Energy Authority.

Shepherd's talk underscored general reaction among delegates on the formation of a space consortium—i.e., that European nations should not attempt to match the two great space powers—the United States and Russia—but should cooperate on development of a less ambitious program with a high degree of scientific return.

Toward this end, working committees last week were established by Eurospace, according to J. Delorme, president of the Eurospace Organizing Committee. Eurospace is the European Industrial Space Study Group which was formed in Paris May 29, to evaluate possible programs.

In general, the only launch vehicle discussed during the three-day session, which attracted about 200 delegates, was the de Havilland Blue Streak, with a variety of stages, including the French Veronique and British Black Knight. However, no commitments have been made for establishing Blue Streak as the single vehicle for a European space venture.

Shepherd stressed that Blue Streak is capable of launching space packages in the initial phases of the program, but contended that any 10-year view must consider development of larger and more powerful rockets (see box). Present European thinking, he said, is in terms of close-orbit payloads of about 2,000 lb.

A reasonable target by the end of the 10-year program, he explained, would be close-orbit payloads of about 20,000 lb.

The question for European scientists, who lack substantial funds available to their U.S. and Russian counterparts, is "how shall we carry 10-ton payloads in 1970 as cheaply as 1-ton in 1960?" according to Shepherd.

To pursue that aim, he continued, European program should look to more immediate possibilities, such as use of liquid hydrogen for fuel, recoverable vehicles and large, inexpensive solid propellant boosters. Liquid hydrogen, Shepherd claimed, seems to offer the greatest possibilities and should be considered the objective for the end of the initial 10-year program. This development should aim at engines of up to 200,000 lb. thrust plus design of a vehicle using a cluster of these powerplants in the first stage.

Shepherd also suggested a long-term study of nuclear power for space vehicles and said the European program should place emphasis on problems of manned spaceflight and flight at very high speeds in the upper atmosphere.

In Shepherd's opinion, the European program should concentrate on pure scientific research with satellites and space probes: civil and commercial applications, primarily in meteorology, communications and navigation, and manned space operations. Attention also should be given to landing small payload packages on the moon on later stages of the program.

In the course of 10 years, he said, it could be expected that a commercial network of communications satellites would "bring in revenue and contribute usefully to world communications."

Because of the many nations involved in a western European joint effort, Shepherd proposed formation of a European Space Development Agency whose first task would be to determine the size and cost of a space program. Next step would be to divide space activities into projects and development areas and to allocate each of these to a Space Center in each of the participating countries. Contracts should be placed on an international basis.

Each center, under Shepherd's proposal, would have full responsibility for conduct of the work on its own project or area, including financial and contractual commitments. The development agency would not exercise any close technical control nor intervene in administration, but would be primarily responsible for planning over-all projects.

European nations, according to Shepherd, should make membership in the organization open to any country in the world and, by its eventual success, could "encourage the space-capable nations of America and Russia to throw their own vast resources into a common pool."

Sublimation of national interests should be a primary aim in the European space venture, delegates were told by Air Commodore F. R. Banks, of Hawker Siddeley Aviation, who warned that military needs of NATO have suffered in the past through a "too selfish and national outlook."

Banks also pointed out the need for international engineering collaboration to link companies which would be supported by their respective governments. But he warned that the scientist in a government department should remain "purely scientific as a consultant and adviser" to those who have to initiate, administrate and engineer the complete space project.

Banks claimed that the aircraft industry should be the natural prime design and manufacturing source for the actual space vehicle and engine, in light of the industry's background in the design of light structures of great strength.

Most reasonable budgetary period for

European Space Program 1961-1971

Vehicle Projects:

- **Phase 1 launch vehicle (based upon Blue Streak).**
- **Phase 1A launch vehicle, utilizing higher energy propellants (i.e., liquid hydrogen/liquid oxygen) in the upper stages to increase payload capacity, but with same first stage as the Phase 1 vehicle.**
- **Phase 2 launch vehicle, capable of placing 20,000 lb. in a close orbit, based entirely on high energy-propellant stages, possible with a 1-million-lb. total thrust cluster of liquid hydrogen/liquid oxygen engines in the first stage.**

Associated with these three main projects would be the development of a small number of appropriate upper stages, some of them interchangeable between the three vehicles listed.

Applications:

- **Instrument-carrying satellites and space probes for space research, utilizing Phase 1 and, in later stages, Phase 1A vehicles.**
- **Soft-landing instrumented lunar probe utilizing the Phase 1A vehicle.**
- **Close and synchronous-orbit communications satellites. Series of launchings and tests leading to commercial use by circa 1970 utilizing Phase 1 and 1A vehicles.**
- **Development of a manned capsule or re-entry vehicle and its use with the Phase 1 vehicle for suborbital flight.**

Research and Development:

- **Full support of research and development in all relevant areas connected with the projects and applications listed above.**
- **Longer term research and development on advanced propulsion systems that might be used in a second 10-year European program, e.g., in nuclear propulsion.**

any undertaking, Banks continued, should be for minimum of five years, a period which could coincide with the life of a government political party in power. Anything less, he said, is impracticable and would tend to slow up the project.

F. Vinsonneau, of the French SEREB said a European consortium should not attempt to compete with the U. S. in space, but should seek to be one of the major partners in the competition between east and west.

British Experience

In support of the use of Blue Streak, Vinsonneau said "we have not pretended, either at home or to our friends abroad, that this is the only solution technically or economically possible . . . experiences and methods gained by the United Kingdom formed a large part of our common fund of knowledge and it would be our duty to support them and prevent their dispersal.

"When our ministries of finance see, on the one hand, what the whole of the Blue Streak program costs and, on the other hand, the cost of the purely scientific program which could, to a large extent, be carried out with imported American equipment, it is a fair bet that they will be left speechless," Vinsonneau said.

The United States has refrained from pushing an American rocket for the European program. A. W. Frutkin, director of NASA's international programs, said "The projects and the launchers are for Europeans to decide. The U. S. government has remained silent so as not to prejudice the matter."

Vinsonneau, who is also secretary-general of Eurospace, backed establishment of a large European laboratory for space research, one which would be "on the scale of those in America."

Studies, Vinsonneau said, should concentrate on:

- **Propulsion,** to make a choice between high energy liquid propellants, free radicals, lithergols, advanced solids, triergols and plasma or ion propulsion, magnetohydrodynamics, solar energy.
- **Development of very light** structures which will resist high temperatures.
- **Reliable microminiaturized** electronic units and high capacity computers.
- **Problems of interplanetary** navigation, and biological and environmental problems of life aboard space vessels.

In another discussion of international cooperation, David Price, an economist and member of the British Parliament, said the United Kingdom is prepared to accept one-third of the cost of the first European space program based on the Blue Streak launcher.

Price said the "most promising" commercial aspects of space lie in the establishment of a communications satellite system.

Prospect of Federal Ownership Arises for Commercial Satellites

Washington—National Aeronautics and Space Council hopes to recommend a national policy on communication satellites within several weeks in response to President Kennedy's request, but industry already is becoming concerned that the group may recommend a government-owned system, at least initially.

The decision to turn the controversial question over to the space council (AW June 26, p. 33), headed by Vice President Lyndon Johnson, has aroused this concern among groups favoring a privately-owned communication satellite system.

A report prepared for the National Aeronautics and Space Administration by United Research Corp., following a NASA-sponsored study, recommended: "Defer private ownership by adopting a policy of interim public ownership with private operation and the clear intention to transfer to private ownership at the earliest feasible time, unless it is later determined that such transfer is not in the best public interest." The report was distributed briefly by NASA, but quickly recalled.

Fear of a recommendation for government ownership prompted one company, which has fought strongly against American Telephone & Telegraph Company's plan for a space communication system, to disclose the United Research Corp. recommendations to representatives of AT&T. It was suggested that AT&T should soften its stand so that all interested companies could present a united front instead of the present divided one.

This concern over government entry into the communications field is sparked also by the belief that NASA Administrator James E. Webb, a close associate of Vice President Johnson, agrees with the general conclusions of the United Research report.

Opponents of government ownership of a satellite system, even initially, point out that the propaganda value of a U.S. satellite system as a showpiece for the free enterprise system would be reduced if it were a government venture rather than a private one.

The United Research report also suggests that initial governmental ownership would provide time in which to determine the optimum conditions for private ownership, to resolve the question of single operator versus joint venture and to review the adequacy of existing regulatory provisions for coping with such a system.

Joint Satellite Group

Washington—Radio Corp. of America believes "the time is ripe for the formation of a joint government-industry group to pursue an aggressive total effort in research and development" to adopt the best technical plan for a commercial communication satellite system, RCA Chairman David Sarnoff told the National Press Club last week. "The much debated question of satellite ownership is, in my opinion, far less important at this time than the adoption of the right system at the earliest possible moment," Sarnoff said. He added that RCA favors the use of synchronous (stationary) equatorial satellites. The RCA official also doubted overly optimistic predictions of potential commercial communication satellite income, observing that total international communications business in the U.S., including satellites, is not likely to exceed $1 billion per year in the next 20 years.

Kennedy Names Taylor His Military Adviser

Washington—President Kennedy has recalled retired Army Gen. Maxwell D. Taylor to active duty as his adviser and staff officer in military and intelligence fields.

The President also nominated Vice Adm. Claude V. Ricketts last week to be vice chief of naval operations with the rank of admiral.

Gen. Taylor, who was Army chief of staff from 1955 to 1959, will be military representative of the President. He is to have "no command authority but will have access to all information necessary for the discharge of his responsibilities to the President," according to the White House.

The White House emphasized that Gen. Taylor will not be interposed between the President and any of such statutory advisers or advisory groups as the secretary of defense, the Joint Chiefs of Staff or the National Security Council. His duties were described as "staff officer advising and assisting the President with regard to those military matters which reach him as commander-in-chief of the armed forces."

Adm. Ricketts, who will replace Adm. James S. Russell, is currently commander of the Navy's Second Fleet and commander, Strike Fleet, Atlantic. Vice Adm. George W. Anderson was nominated earlier as chief of naval operations.

1961 Piper Profits Drop Sharply; Plant Costs, Recession Blamed

By David A. Brown

New York—Fiscal 1961 will prove to be a less satisfactory year for Piper Aircraft Corp. than the company's original predictions indicated, W. T. Piper, vice president, told the New York Society of Security Analysts here last week.

The present year has been "very unsatisfactory to us" so far, he said, and he expects no upturn for at least three months. While unit sales compare favorably with Fiscal 1960, dollar volume is off 20% and profits are off 72%, he said.

(Piper stock declined 6⅝ points on the New York Stock Exchange after the speech.)

Currently, profits are estimated for the fiscal year at $1 per share. The original profit estimate for Fiscal 1961 was $2-$2.50 per share. In March this was scaled down to $1.75 per share for the year and has since been reduced to the present estimate.

This drop is due primarily to three factors:

- **Introduction of the Colt**, a two-place version of the Tri-Pacer, mainly to stimulate dealer activity and strengthen the sales organization. The model has been responsible for large unit sales, but profit margins are small.
- **Demand** for the firm's money-makers—the Comanche series and the light twins—has fallen off sharply due to the general business recession.
- **Unexpectedly high cost** of putting the new Vero Beach, Fla., plant into operation has reduced profit margins. So far, $1.25-million has been spent in Fiscal 1961 and the cost may reach $2 million by the end of the fiscal year.

The current low profit scale was caused about equally by the general business recession and the new plant costs, Piper said. He added that, due to the recession, the Vero Beach plant opened at an "inappropriate" time.

Another reason for Piper's profit drop is the effect on the market of the Cherokee, a low-wing replacement for the Tri-Pacer. Announcement of the new model immediately killed sales of the Tri-Pacer, he said.

During the first seven months of 1960, a total of 440 Tri-Pacers were sold, accounting for dollar sales of $2,863,000 and net profits of approximately 20 cents per share. In 1961, in place of this 20-cent profit per share, there has been a pre-tax loss of approximately $1.15 per share. Piper estimated that had the firm not put the new plant into operation, but instead continued production of the Tri-Pacer (assuming the model would have sold), the net profit for Fiscal 1961 to date (the first seven months) would have been approximately $1.38 per share. The firm earned $2 per share during the first seven months of Fiscal 1960, the best year in Piper's history.

It originally was expected that first sales of the Cherokee would be made in February and that by May, production at Vero Beach would reach at least one unit a day. Instead, it was not until May that the first eight Cherokees were delivered from the Florida facility and production is only now reaching the one-a-day volume. Production is expected to increase to two a day in July, three a day by the end of the fiscal year in September and, eventually, to a maximum of five a day. The major factor in the delay so far has been the lack of experienced labor in the Vero Beach area, Piper said.

"In effect, we have gone about six months now without a low-cost, four-place plane on the market," he added.

The recession may be "bottoming out," Piper said, although this has not yet been felt at the factory level.

"AVIATION WEEK, in its May 29, 1961, issue [p. 69], reported signs of a rising trend in business aircraft sales,' " Piper said.

He said the demand for more expensive models in the Piper line has not increased at factory level, but distributors' stock has continued to move and dealers in some sections report an improvement in buyer interest.

Piper foresees a good upturn in sales and profits for Fiscal 1962. The firm estimates that sales will increase to $43-$45 million for the year and that profits will increase to a minimum of $3 per share.

Noting that some analysts question the ability of a company to rebound to what would be the top sales level in its history after a 20% decline the previous year, Piper said forecasted sales indicate this is just what will happen (see table).

Sales of this magnitude would represent an $11-million to $13-million increase over Fiscal 1961. The profit margin would be below Fiscal 1960's 19%, but should be about 16% before taxes.

This profit margin, however, will depend a good deal on whether the anticipated volume of more expensive models is realized and also on whether the company can achieve efficient production of the Cherokee at Vero Beach. Piper eventually hopes to produce about 1,100 Cherokees per year and a total of 10,000-12,000 over a peroid of 8-10 years.

The company is working on these major development projects:

- **Fuel-injection** versions of both the 180 and 250 Comanche this year, probably in September or October. Lycoming will begin production of the new engines in late July or early August.
- **Modifications** of both the Aztec and Cherokee.
- **24-channel transceiver** with whistle-stop tuning and an omni-indicator, similar to the Narco Omnigator. The set, now being flight tested by Piper, will be on the market in the 1962 models, priced at about $600.

Piper also said:

- **Construction** of a third production factory is contemplated somewhere in the Southwest within six years, if business remains good.
- **Little competition** is expected from European manufacturers of business aircraft. Piper said that traditionally European planes are never sufficiently tooled to be considered production models and are virtually "custom built."
- **Continued good sales** abroad are expected. Piper's foreign sales for Fiscal 1961 are running slightly ahead of the previous year and buyer interest in foreign countries seems to be expanding.
- **Little demand** is in evidence for additional Navy Aztecs (UO-1).

Piper Unit Sales Figures

	1960	1961 (est.)	1962 (est.)
Super Cub	356	234	198
Colt	–	1,123	1,029
Pawnee	373	228	300
Tri-Pacer	590	44	–
Cherokee	–	130	1,078
Comanche	828	626	720
Apache	97	97	90
Aztec	297	164	200
Used	44	48	40
Military	13	8	2
Totals	2,598	2,702	3,657

Three-Satellite Launch Orbits Snap Unit

Washington—Two firsts in space operations marked the successful launching of Navy's Transit IV-A navigation satellite June 28 when a nuclear auxiliary power unit was carried aloft and three satellites were put into orbit at the same time.

Atomic Energy Commission completed safety tests on its plutonium 238 radioisotope thermoelectric generator some time ago, but political considerations had prevented its use in space.

Combined weight of the basic Transit payload and its two pick-a-back research satellites was 265 lb. Inclination of the orbit is 66.68 degrees. Initial apogee was 546 naut. mi. and perigee was 484 naut. mi. Period of orbit was 104 min.

Separation of the satellites was verified by telemetry and moonwatch sightings. Explosive bolts and springs forced them apart at 1.0 fps. In the 50-yr. estimated lifetime, the satellites will change relative positions many times.

Two transmitters operating on 54 and 320 mc. are being powered by the radioisotope power pack and two others are being powered by solar cells.

One pick-a-back satellite is Injun, formerly called Hawkeye, designed by the University of Iowa for the Office of Naval Research to measure the cosmic rays, solar protons and charged particles of the Van Allen belt and to study origins of aurora.

The other satellite is Greb III developed by the Naval Research Laboratory to measure solar x-ray radiation to relate its intensity to changes in the ionosphere.

The power unit is similar to the Snap 3 unit which uses polonium 210 as a fuel. It develops two and one-half watts of power compared with three watts for Snap 3. Numerous safety tests subjected the type to flash heat of 5,100F and steady temperatures of 1,200 to 1,600F for periods of 15 min. after first subjecting it to impact loads such as would be experienced in a launching or flight accident.

It was developed by the Martin Co. and the fuel core was loaded by AEC's Mound Laboratory at Miamisburg, Ohio, which is operated by the Monsanto Chemical Co.

X-15 Pressurization System to Be Changed

Edwards AFB, Calif.—Cabin pressurization system of the North American X-15 will be modified because of a series of failures in tests here.

USAF Maj. Robert White flew the last test to a record speed of 3,603 mph. with his pressure suit distended and nearly rigid because of a drop in cabin pressure. The Mach. 5.3 top speed was achieved at 97,170 ft. in a flight that reached a maximum altitude of 107,700 ft.

The X-15 has no system specifically designed to maintain cabin pressure. As liquid nitrogen is evaporated to cool cabin instrumentation and the pilot's suit, it is exhausted into the cabin. A pressure relief valve prevents cabin pressure from rising above normal levels but no provision was made to sense low cabin pressure since the designers were confident that the cooling flow would be more than adequate to pressurize the cabin.

Paul Bikle, chief of the NASA high speed test station, told Aviation Week that engineers on the project have concluded that the coolant flow is not balancing cabin leakage. The number two airplane which White flew in the latest test will have its cabin resealed and an under-pressure sensor will be installed to vent more nitrogen into the cabin if needed.

The nitrogen is heated to a tolerable temperature before it is released into the cabin. Cabin leakage has been rising as the X-15 has accumulated time in the air. Recently, leakage has varied between 48 cu. ft. per min. and 55 cu. ft. per min. Design specification for the airplane set a maximum leakage of 15 cu. ft. per min.

Bikle said the pressurization failures were at first thought to be the result of component malfunctions but subsequent tests have shown no evidence of this. Re-sealing of the cabin, installation of a cabin pressure sensor and inlet valve, and the addition of improved fairings on the side tunnels for wiring and plumbing will keep the number two X-15 grounded for an estimated five weeks. No tight schedule has yet been established for the modifications.

During the 11-min. flight which White made with his suit inflated, a maximum temperature of 830F was recorded on the lower surface 15% of chord aft of the leading edge.

News Digest

President Kennedy's Scientific Advisory Committee is forming a special panel to study the entire nuclear testing problem, including the possibility of secret Soviet testing, Soviet nuclear progress, and the requirement for the U.S. to resume tests. Study is being made for the President, Joint Chiefs of Staff, and National Security Council.

United States Disarmament Agency for World Peace and Security was proposed to Congress last week by President Kennedy, with Defense Department and State Department support. It would have authority to direct all activities related to arms control, from technological research on developing inspection systems to political, economic and propaganda planning. The agency's director also would serve as Presidential disarmament adviser.

Radio Corp. of America report last week of studies with non-linear dielectrics, or semi-insulators, raises the possibility of a whole new class of important active avionic components emerging from basic studies now in progress.

Brig. Gen. Don Flickinger, special assistant for bioastronautics to the commander of Air Force Systems Command, will retire this month after 24 years of service. He does not plan to join any company, but will become an independent consultant.

Umbaugh Aircraft Corp. will take over subassembly, final assembly and quality control for the Umbaugh U-18 autogyro at its own leased facilities at Hagerstown, Md. Fairchild Stratos Corp. will continue to provide shop support for the Umbaugh-managed certification program and will be prepared to manufacture tooling and sheet metal parts. Both Umbaugh and Fairchild have executed general releases from all previous contracts and agreements between the two companies.

General Electric received a $4-million Air Force contract last week to produce two prototype YJ93-GE-3 turbojets and provide factory and field service for them. This engine is under development for the North American B-70.

Machine Translation, Inc. has developed a new technique for automatic machine translation which can translate from one language to another contextually at 60,000 words per hour.

Pan American Grace Airways asked Civil Aeronautics Board last week to extend its route system from Panama to Miami, Washington and New York.

Willard L. Gorton, assistant engineering manager of Pratt & Whitney Aircraft Division of United Aircraft Corp. since 1958, has been named general manager of Pratt & Whitney's Florida Research and Development Center. Charles T. Roelke, who has been general manager there since the center was established, continues as assistant general manager. The company said Gorton's assignment reflects the "steadily increasing technical importance" of the facility.

Dispute Hampers Iberia on North Atlantic

Competitive position weakened by internal fight over pushing New York or Latin American market

By L. L. Doty

Madrid—Competitive position of Iberia Airlines of Spain on North Atlantic routes is substantially weakened by sharply split opinion within the airline on where its major market lies.

Never a strong contender in the New York-Europe market, which it has been serving since 1954, Iberia still shows no signs of challenging its North Atlantic competitors even though it was scheduled to put Douglas DC-8 turbojet transports in service July 1. Chances are strong that it will never develop into a competitive threat until it defines its goal.

One faction within the company wants greater frequency of schedules between New York and Madrid and more promotion and advertising in the U.S. to generate higher volumes of traffic on the North Atlantic route. The opposing faction holds that Iberia's natural market is in Spanish-speaking Latin American countries and that the North Atlantic route should be maintained only for prestige and diplomatic purposes.

Both factions are being appeased by acquiring an equal share of the flight equipment available. As a result, the carrier's fleet of three DC-8s will be thinly spread to serve four transatlantic routes: New York-Madrid, Santiago-Madrid, Bogota-Caracas-Madrid and Mexico-Havana-Madrid. Obviously, no route will get the frequency of jet service needed to match the schedules of Iberia's major competitors.

Government Obstacle

Biggest block to any improvement in this situation is the heavy hand of the Franco government which, through Insituto Nacional de Industrias (INI) —government agency that owns Iberia— holds a tight purse string on the airline's expenditures. Iberia is thus bound to an economic philosophy that undoubtedly frustrates the obvious airline talent on the company's roster. From ticket offices to flight and ground operations and the carrier's efficient overhaul shops here at Barajas Airport, it is evident that Iberia is fully equipped to achieve success if it were given more freedom of action.

Observers here feel that prospects for any radical change in this government-airline relationship are dim. Major fear among this group is that INI will move a high-ranking air force officer into the company's top operating position of director and general manager, which is expected to be vacated shortly when Cesar Gomez Lucia, Spain's elder aviation pioneer, retires from the post. The real need is for a marketing-airline specialist with full authority to resolve the route issue, obtain sufficient flight equipment and set an operating goal for the airline.

Despite an aggressive and imaginative sales staff in the U.S., Iberia has lost rather than gained in its share of the U.S. market. The staff is so small that adequate geographic distribution of sales efforts is impossible. Sales tools are limited, and advertising and promotion is held to a minimum. The faction favoring development of the U.S. market deplores the lack of funds that creates this limitation.

With only four North Atlantic round trips in the summer and three in the winter, travel agents are inclined to sidetrack Iberia in developing itineraries for their clients because of the nuisance of finding departure dates in timetables. They find it easier to select an airline with daily departures from the New York gateway.

In an Aviation Week survey covering typical three-month test periods, Iberia was found to have a smaller share of the North Atlantic market than any of the 14 other scheduled carriers serving the route, including Air-India International which entered the market only slightly more than a year ago. In the number of passengers flown in 1960, Iberia ranked at the bottom of the list. With capacity swelling and traffic dwindling generally (AW June 26, p. 38), Iberia faces a dismal summer season on the North Atlantic.

The carrier's best market is Caracas, Venezuela. Santiago, Chile, a market which the carrier will enter in August, is promising, and Mexico City also is an excellent source of business. Traffic eastbound out of Havana is so heavy that waiting lists are backlogged over periods of weeks. There is virtually no traffic westbound from Spain to Havana.

Principle reason behind this one-sided flow of traffic is that Cubans can escape the Castro government by flying to the U.S. via Spain. The refugees are required to purchase round-trip flight tickets from Havana to Spain, but once in Madrid they attempt to get U.S. visas and then purchase a one-way ticket to New York. Popularity of this strategy would seem to attest to its success.

The issue of high jet capacity is looming as an almost insurmountable problem to Iberia. With a current load factor of only 24% on its piston-engine Lockheed Super Constellations over the North Atlantic, the carrier visualizes a further load factor decrease with the DC-8s in operation.

Little Increase Seen

It foresees no substantial traffic increase to help fill the rising available seat volume. It will have a speed advantage over its North Atlantic competitor, Trans World Airlines, since TWA serves Lisbon on the route and must stop at the Azores to refuel because of runway limitations at Lisbon. Iberia can—and will—fly nonstop Madrid-New York, but it doesn't feel that this speed margin will win any impressive number of new customers.

Spain has successfully barred new competition from entering the Madrid-New York market. Pan American World Airways has fought unsuccessfully for several years to penetrate the market by serving Madrid on its New York-South Africa route, but Spain has consistently refused to grant the route.

As a result, the U.S.-Spanish bilateral air transport agreement is now open. And it is likely to remain that way for some time since Spain insists that it must have either a Montreal-San Francisco route or a New York-Mexico City route before it can even consider meeting Pan American's route request.

TWA feels there is sufficient traffic to accommodate both airlines. Tourism is big business in Spain—now surpassing in dollar volume the sherry and olive industries for the first time—but it is not the U.S. tourist who is filling Spain's hotel and restaurant tills. Scandinavians, British, French and Germans, lured by the low cost of living as well as by the charms of Spain, account for the bulk of tourists. As long as Spain stays out of the European Common

Market, tourist costs are not likely to inflate to such a degree that the low-cost advantage will be lost.

U. S. tourist traffic is generally in a single direction, with passengers entering Europe through the popular gateways of London, Paris or Frankfurt and embarking for the home journey through Madrid or Lisbon. Madrid historically has ranked behind Rome, London, Paris or Frankfurt for TWA in passenger loadings. So far this year, Madrid has moved into second place in this category, only slightly behind Rome.

Iberia would like a second European gateway to help offset this single-direction pattern but has not asked its government to bid for such a point because of its severe equipment shortage. Meanwhile, the airline is reaping the benefits of its appeal to European tourists on its European routes, although it is now experiencing traffic losses to such carriers as Transair Sweden and Deutsche Flugdienst which are offering low competitive rates to the Canary Islands under charter and package tour plans.

Iberia's problem on its European routes is exactly the opposite of that on its North Atlantic routes. Heavy load factors on the fleet of Convair 440s which serve these routes are causing some officials of the company to wonder whether the four Sud Caravelle turbojet transports it has on order will have sufficient capacity to accommodate the traffic it anticipates during the next few years.

Tourist Growth

Spain is rapidly developing its southern coast as a tourist center and visualizes an area that will match the French and Italian Rivieras. An airport with runways sufficiently long to handle long-range turbojet transports is now under construction at Malaga. Spain also is promoting its Canary Islands as a tourist attraction. The Costa Brava and the island of Mallorca continue to hold leading positions as points of tourist interest.

Iberia is constructing hangar facilities in the Canaries to handle its maintenance and overhaul as well as that of Aviaco, Spanish domestic airline, which also operates the inter-island routes of the Canaries. And $2.5 million is being spent here at Barajas Airport for new buildings and hangars, including such employe facilities as restaurants, medical quarters, a swimming pool and a jai alai court.

Iberia is not without a good source of highly skilled mechanics, welders, grinders or tool makers to keep its ground crews adequately staffed. It is now concerned, however, that it will have difficulty finding pilots to meet its jet needs.

International Aviation Probe Urged As Clashes on Bilaterals Continue

Washington—Immediate, wide-scope Senate investigation of international aviation was called for last week by Sen. Norris Cotton (R.-N. H.) as the U. S. continued to clash with foreign nations over interpretations of its bilateral air transport agreements.

Sen. Cotton introduced a resolution authorizing an investigation by the Senate Commerce Committee or a subcommittee in a Senate floor speech charging that many nations are using illegal restrictions to curb U. S. carriers while some foreign airlines are "flagrantly violating the capacity provisions" of bilateral agreements. He said violations are "increasing" and are "unchecked." The resolution was referred to a committee for consideration.

Meanwhile, British and U. S. delegations in London went into a complete deadlock over capacity restrictions during talks on additional air service in the Caribbean area. The British, once strong advocates of a restrictionist policy, virtually sided with the Dutch and Scandinavian position by contending that the Bermuda agreement, the standard for most transport pacts, made no provisions for control of traffic.

The U. S., original backer of free competition and "freedom of the skies," has been maneuvering to get foreign nations to accept its position that traffic can be restricted through a proper interpretation of the Bermuda agreement. The British flatly refused to agree to this interpretation, and the London sessions were recessed on this basis.

During the negotiations, the U. S., British and West Indies delegations agreed to the grant of two routes to the U. S.—New York-Jamaica and Atlanta-Jamaica. A route between Antigua and New York was granted the British until the West Indies become independent, when the route will be transferred to the West Indies Federation.

Last week, Qantas Empire Airways continued its fight for the right to serve Tahiti on its U. S.-Australia route. Last month, Civil Aeronautics Board Examiner Joseph Fitzmaurice recommended against the service (AW June 12, p. 38).

Qantas replied that Fitzmaurice should have accepted the State Department's interpretation of the bilateral agreement between the U. S. and Australia, which supported the Qantas contention that it is entitled to serve Tahiti.

Qantas stated that the State Department interpretation of the agreement is not "open to review by or collateral attack before the Board and is therefore binding on the Board."

Sen. Cotton touched on the core of the over-all dispute between the U. S. and foreign flag carriers on the international air transport issue when he noted that the Bermuda agreement was written in 1947, at a time when the U. S. had a preponderance of aircraft, personnel and experience. He added, ". . . a lot of things have changed since then, and it is obvious that the Bermuda principles are not a very satisfactory answer to the problems of international aviation today."

Sen. Cotton warned that the loss of U. S. traffic to foreign flag carriers is limiting the ability of airlines to increase employment, industrial capacity and foreign investment. He said that dollars earned by foreign carriers will tend to worsen the outflow of gold over a period of 10 years.

He noted that a number of new airlines, representing newly formed independent governments, will seek entry into the U. S. Urging that losses of traffic to foreign airlines be curtailed, he said that ". . . the government has been excessively and damagingly generous" in granting routes.

In his resolution, Sen. Cotton asked that these issues be raised during the proposed Senate investigation, which would be required to produce a final report to Congress by January, 1962:

- **Decline of the share** of U. S. flag carriers in international air transportation.
- **Federal policy** on negotiations of bilateral agreements.
- **Authority, responsibility** and organization of the CAB and State Department with respect to such policy.
- **Enforcement** of the provisions contained in bilateral agreements.
- **Effect of international** agreements on domestic air commerce.

Frontier Negotiating For British Transports

Frontier Airlines signed a letter of intent last week for six BAC 111 transports powered by aft-mounted Rolls-Royce Spey turbofan engines.

Actual purchase of the British Aircraft Corp. aircraft, at a total cost of $12-million, depends on negotiations this fall and signing of a contract prior to January, 1962.

Earlier this year, Ozark Air Lines signed a letter of intent to purchase five of the twin-engine aircraft, and Continental Air Lines also has expressed interest in the aircraft. British United Airways has signed for 10 of the aircraft with an option for five more.

Helicopter Lines Claim Subsidy Cut Would Bar VTOL Breakthroughs

Washington—Helicopter airlines told Congress last week that cutting off their subsidy would deny the nation a technical breakthrough in the VTOL field.

The carriers used this argument during Senate Appropriations Independent Offices Subcommittee hearings and in a private meeting with the counterpart House committee last week as they campaigned to restore the $1.9-million House cut in Fiscal 1962 helicopter subsidy. They also are working to spike the recommendation that no subsidies be paid after Fiscal 1962.

The House Appropriations Committee served notice in its recent independent offices report that Fiscal 1962 is "the last year the committee plans to recommend funds for the subsidy of helicopter operations." The committee also recommended cutting the Fiscal 1962 helicopter operations subsidy from the requested $6.9 million to $5 million. The House approved the subsidy cut, so the carriers are concentrating efforts in the Senate.

Clarence Belinn, president of Los Angeles Airways, said "Congress should at least encourage a substantial expansion of the present [helicopter] operators, so as to provide an optimum criteria before passing judgment rather than cause a retraction based upon unrealistic criteria." He said the language in the House report "throws a kink in all long-range planning" of the helicopter airlines.

C. W. Moore, vice president of Chicago Helicopters Airways, said the $1.9-million cut passed by the House would prevent carriers from buying turbine helicopters, while the elimination of subsidy after Fiscal 1962 would put the scheduled helicopter lines in Los Angeles, Chicago and New York "entirely out of business. . . . This would occur at the very time that real progress is being made in the helicopter field."

He said twin-turbine helicopters "will provide a bigger breakthrough toward self-sufficiency than the DC-3 provided for the trunk lines." The Sikorsky S-61 helicopters soon to be acquired, Moore said, will cut direct operating costs per seat mile on his line by 51%. This compares with the 27% reduction effected by the introduction of the DC-3, he said.

Robert L. Cummings, New York Airways president, said although the change to twin-turbine helicopters will require increased federal subsidy of operations at first, ultimately the new equipment would increase efficiency and revenues to the point where subsidy can be reduced.

"The significant consideration," Cummings told the Senate subcommittee, "is that the new equipment has this very real potential for subsidy reduction whereas the existing equipment does not." He said ending the subsidy after Fiscal 1962 would be "wasteful" since a technological breakthrough on helicopter operations is imminent.

Sen. A. S. Mike Monroney (D.-Okla.), member of the Appropriations Subcommittee and chairman of the Senate Commerce Aviation Subcommittee, indicated he feels helicopter subsidies are justified. Without them, he said, "I see no way in which we will not go backward in this phase of aviation instead of trying to move forward and break the technical barrier."

House Unit Approves Supplemental Bill

Washington—House Transportation and Aeronautics Subcommittee last week approved the Kennedy Administration bill to permit Civil Aeronautics Board to issue supplemental air carrier certificates.

The bill, which still faces a severe test in the parent House Interstate and Foreign Commerce Committee, would not give the degree of permanence to the supplementals sought by industry leaders but would assure their continued operation.

Supplemental carriers are flying under special legislation passed by Congress last summer to stay the effects of a court order invalidating their certificates.

This special authority expires Mar. 14, 1962.

Clayton L. Burwell, president of the Independent Airlines Assn. and Supplemental Air Carrier Conference, asked the House subcommittee to give the supplementals "a minimum bill of rights," declaring the industry can not get financing for equipment under its limited operating authority and "is going broke."

The Kennedy Administration bill would authorize the CAB to issue certificates to supplemental carriers qualified under criteria tailored to the industry and to issue grandfather certificates to carriers whose operating authority has not been revoked or are flying under the interim congressional operating authority.

The bill also would enable the CAB to issue certificates which do not specify the terminal and intermediate points for the supplemental carriers and which limit such factors as frequency of service and equipment. CAB Chairman Alan S. Boyd told the House Transportation and Aeronautics Subcommittee that "supplemental air carriers have performed a useful public service and have a definite place and role in meeting this nation's air transportation needs.

"There can be no doubt that the continued existence of the supplemental air carrier fleet is of real value in terms of national defense, and it is evident that the future ability of the supplemental air carriers to serve the military, as they are doing now and have done so ably in the past, depends upon their ability to operate their planes in commercial activities when not engaged in service for the military."

Burwell said the Administration bill "fails to clarify certain problems or to consider any expanded authority, which if handled by the board, would result in hearings so extended that the industry will perish before relief could be extended if deserved." The Senate Aviation Subcommittee has held hearings on the supplemental air carrier legislation and is expected to report a bill similar to the Administration's.

Senate Unit Rejects CAB Reorganization

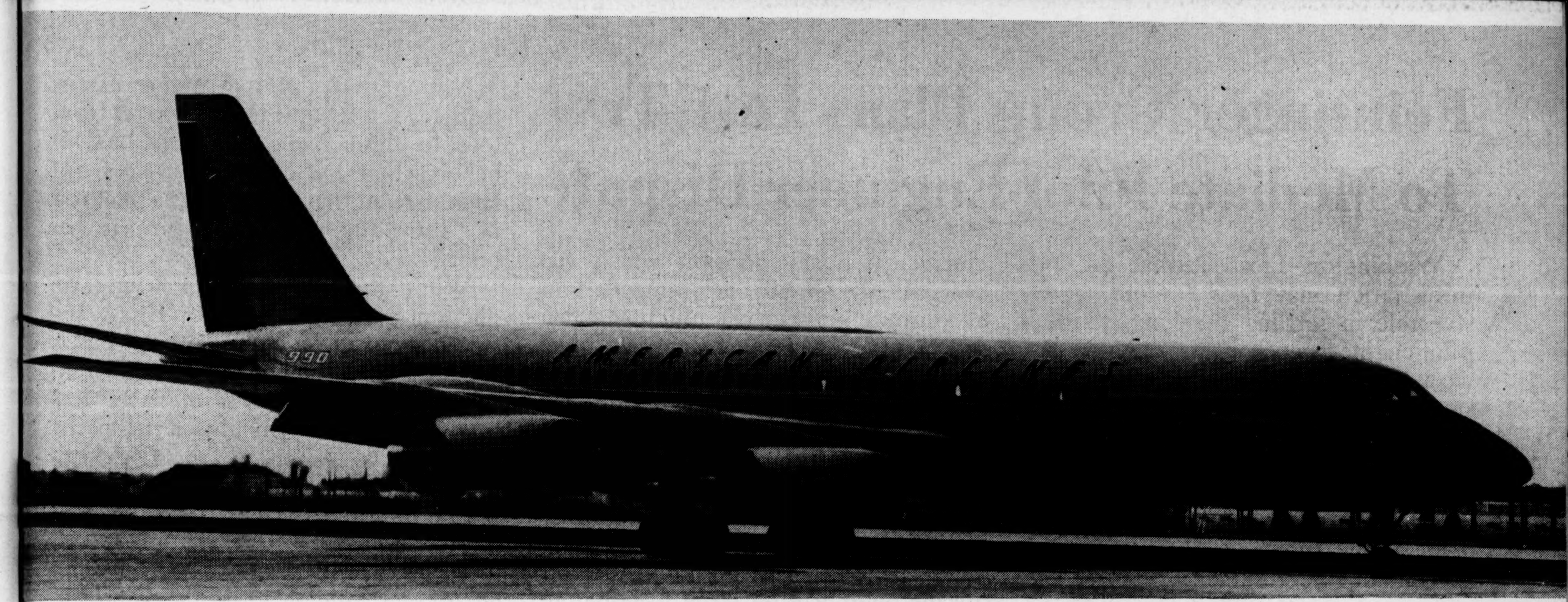
Washington—President Kennedy's plan to reorganize the Civil Aeronautics Board was rejected by the Senate Government Operations Committee last week.

The Senate committee staff, in a memorandum on the reorganization proposal, said if streamlining of the CAB is needed, it should be done through legislation.

Along with this general criticism, the staff memorandum said the plan recommended by the President allows CAB members to delegate so much power to subordinates that persons dealing with the board may be denied "substantive rights." The memorandum added that this delegation puts policy making in the hands of staff members who are not subject to Senate scrutiny and confirmation.

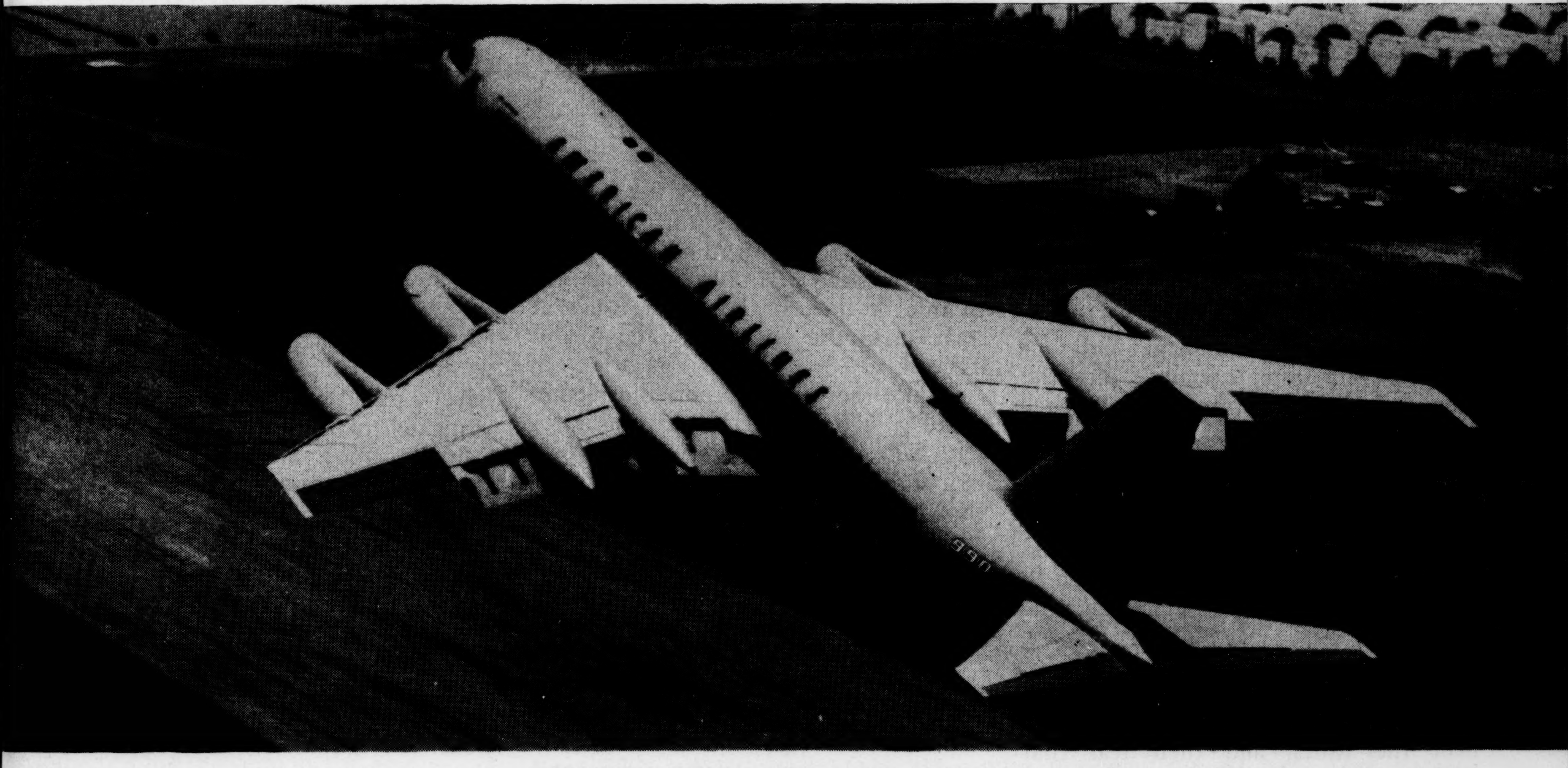
"The committee believes," the memorandum said, "that when the Congress vests in a regulatory agency important policy-making, rule-making and adjudicatory functions, it is neither desirable nor in the public interest to permit such functions to be delegated to subordinates without limitations, and subject only to discretionary review of their determinations by the agency."

The House rejected a resolution June 20 calling for disapproval of the President's CAB reorganization plan. Disapproval by either the House or Senate is enough to kill the plan.


990
AMERICAN AIRLINES

Flight test Convair 990, with American Airlines' markings, shown at Los Angeles International Airport (see p. 40).

Convair 990 Will Begin Service in December



Convair 990 is shown taking off from Lindbergh Field in San Diego. Note aerodynamic anti-shock bodies on trailing edges of wings. Aircraft is powered by four General Electric CJ805-23 aft-fan engines. Photo was taken by a Convair crew from a helicopter.

AMERICAN AIRLINES

Feinsinger Group Plans Last Try To Mediate Pilot-Engineer Dispute

Washington—Prospect that the Administration may take a more aggressive role in settling the long standing pilot-engineers cockpit dispute grew last week as a special White House commission announced a new series of talks July 8-10 with airlines, the Air Line Pilots Assn., and the Flight Engineers International Assn.

After more than a month of fruitless negotiations, the commission, headed by Nathan P. Feinsinger, is expected to make a last attempt to permit the parties to settle the labor dispute themselves along lines suggested by the commission (AW June 12, p. 47). The meeting is scheduled to be held in Palo Alto, Calif.

Continued failure to reach any mutually acceptable agreement will make it necessary to require further recommendations, the commission has warned "as may then seem desirable" (AW May 29, p. 33). Basic recommendations of the Feinsinger report—that the engineers' union merge with ALPA, that turbojet flight crews should be limited to three men and that flight engineers should also be pilot-qualified—have been flatly rejected by FEIA.

Contending that the merger and pilot training provisions literally "put the crew complement argument right back where it was," the engineers union has continued to meet with the commission, but refused to participate in any "Joint Committee on Inter-Union Co-operation" which Feinsinger suggested be established by the two unions to negotiate on the report's recommendations.

Airline Concern

Indicative of the airlines' concern over the issues, and their fear that FEIA might strike if collective bargaining with individual carriers fails, is a claim by spokesmen for the union that four carriers involved in the industry-wide Feinsinger commission proceedings—American, Pan American, Trans World and Eastern Air Lines—have asked Labor Secretary Arthur Goldberg to remove the union from the procedures of the Railway Labor Act and make it subject to any final recommendations of the commission. The union said it has "strong assurances" from the Labor Department that the request will not be granted.

Uncertainty among the airlines over specific recommendations that may be made in any final report by Feinsinger have delayed contract talks with several carriers, FEIA said, and have been directly responsible for a presidential emergency board decision which has avoided any specific recommendations in a dispute between the union and Pan American. Negotiations have continued at American, Eastern and National and are in mediation on Trans World Airlines.

While the Feinsinger report intentionally avoided any discussion or recommendation of a reduction in monthly flight times as one method of easing flight crew employment problems, this specific point will be a key issue before the commission's new meetings. Urged by FEIA in its talks with the commission and in several airline contract negotiations, as well as by several ALPA councils in current negotiations, the question of flight time reduction has not been accepted by airlines primarily because of the increase in operational costs involved.

Industry Settlement

Anticipating industry-wide settlement of the FEIA-ALPA dispute by the Feinsinger commission, the presidential emergency board at Pan American emphasized that it was "impossible" to rule on any of the major issues at stake until the commission completes its work.

While the board's report did recommend a 5% retroactive pay raise for Pan American engineers over the past year and also made several recommendations on minor issues, it urged the adoption of a provisional agreement which would leave all major FEIA demands for reduced flight times and increased wages open for later negotiation.

Emphasizing the "dilemma" of both itself and the parties, the board pointed out the cost impact which FEIA demands would have on the airline and stated that Pan American is in no position to "offer significant concessions" to the engineers until it has some knowledge of the outcome of the commission's efforts.

Reviewing the events which led to the appointment of the board on Feb. 17, after a year of negotiation between the company and the union, the board said that FEIA's demands, which would have "the net effect of requiring the employment of additional engineers, at considerable expense," combined with the Feinsinger group's industry-wide efforts, placed Pan American and the union in a "unique and probably unprecedented set of circumstances," forcing the board to face a "dilemma which none of its predecessors has had to meet."

Noting that the commission favors reducing the present turbojet crews from four to three men, the board said it believes that the commission does not favor a reduction of hours as a method of "providing work for engineers [or pilots]."

While the matter of an hourly reduction has been urged by FEIA before the commission and by both FEIA and ALPA in negotiations with Pan American, the board said, there has been no serious bargaining on this point between Pan American and the engineers.

The positions of both the union and the carrier on this issue are "precisely" what they were over a year ago, the board said, adding that the probable reason for this is that the cost impact is of "paramount importance."

In its conclusions, the board urged that Pan American and FEIA realize that they are in a "transition period, and must be guided by the realization that not all problems can be solved immediately or simultaneously."

Ticket-Publicity Trade Criticized by CAB Unit

Washington—Exchanging free airline transportation with celebrities and journalists for publicity has been added to a growing list of violations and unfair competitive practices which Civil Aeronautics Board enforcement attorneys have warned will be more closely investigated in the future.

Investigation of restricted membership airline passenger clubs by CAB's Bureau of Enforcement is still under way, with airlines scheduled to reply late last week to a bureau letter suggesting that clubs either be abandoned or made available for general public use (AW June 5, p. 42).

In a letter to airline presidents, the bureau outlined what it considers violations of regulations covering the exchange of transportation for services, which may result in the filing of formal enforcement proceedings against the airlines in the future. Typical violations cited by the Bureau were listed as "merely illustrative," since new variations are "limited only by ingenuity."

Exchanges which the Bureau considered violations took these major forms:

- **Celebrity endorsements** of one airline's services were obtained by the carrier under a direct negotiation with an advertising agency.
- **Personal service** provided by communication sources in exchange for transportation.
- **Exchange of transportation** for advertising services on a dollar-for-dollar basis.
- **Advertising tie-ins** with prize contests.

BOAC Appeal Awaited on Cunard Award

By Herbert J. Coleman

London—Final decision on an expected BOAC appeal against Cunard Eagle Airways' New York-London route award will be made by British Minister of Aviation Peter Thorneycroft (AW June 26, p. 39).

The appeal, which must be filed by July 13, is being watched closely by the 16 British independent airlines and particularly British United Airways which is in the midst of hearings on routes that would, if awarded, compete with British European Airways.

Thorneycroft will appoint an independent commissioner to review the Air Transport Licensing Board decision, but he alone makes the final disposition and could overrule the board and the commissioner to reverse the Cunard Eagle grant (AW May 22, p. 34).

Considering this possibility, much speculation currently is centered on a paragraph in the board's findings, noting that the minister of aviation "has not used his powers under Section 2 (subsection 3) of the Civil Aviation Licensing Act of 1960 to direct the board to refuse the Cunard Eagle application."

By mentioning this section of the act, the board apparently feels that in granting Cunard Eagle a parallel route on the North Atlantic as a second British flag carrier, as it can under the Anglo-United States air agreement (Bermuda agreement), the present bilaterals between the United Kingdom and the U.S. will not be disturbed.

Cunard Eagle last week applied to the Civil Aeronautics Board for the necessary U. S. Foreign Air and Carrier Permit.

Trans World Airlines and Pan American World Airways, the two U. S. flag carriers which are now on the route and operating in competition with BOAC, are expected to intervene in the case.

In discussing the grant to Cunard Eagle, BOAC spokesman said the flag airline is "surprised and deeply disappointed" and the appeal to the board's decision will be based on a "material diversion of traffic," the basis of BOAC's case during the hearings. Noting the board expected some diversion from BOAC, the airline said "if this be the case, BOAC's position on the North Atlantic will be undermined."

The airline feels that parliamentary intention, as embodied in the act, was that this should not occur.

In its ruling, the board declined to grant Cunard Eagle operating rights to Montreal and Toronto, Canada, or to the U.S. Midwest, Chicago and Detroit, as was requested in the application. The airline also will not be allowed to carry mail on its North Atlantic services.

The board's view is that to license a second British carrier to Canada would lead to "wasteful duplication" and "material diversion," and this route at present cannot support two British carriers. The board explained that by 1966-67 there will be more than one million passengers flying the Atlantic between the U. S. and Great Britain but that by that time, the Canadian traffic will be only about 350,000 passengers per year with a lower growth rate. Present North Atlantic traffic runs more than 2 million passengers a year, but this includes many who fly to other countries besides the United Kingdom.

Cunard Eagle, during the hearings, made a strong point that it would generate new traffic on the North Atlantic, and the board apparently agreed with this contention while admitting there would be "material diversion" from BOAC. The key word, according to the board, is whether such diversion would be "wasteful."

Said the board: "to an extent which we have no means of assessing, the advent of another operator, and especially of one with the backing of the extensive sales organization of the Cunard Steamship Co., Ltd., [Cunard Eagle's parent] may generate new air traffic. But there will be diversion, and probably 'material diversion' from BOAC in the sense that a Cunard Eagle service, if successful, will inevitably carry traffic which might otherwise have been carried by the corporation.

"Nevertheless, we do not regard this as necessarily a bar to the grant of a license, because:

- "**To do so would preclude** the grant to any operator of a license on any route already serviced by another United Kingdom operator, thus 'freezing' the existing situation on such routes—a result which we cannot believe to have been intended when the act was passed.
- "**It is common ground** that traffic is likely to increase so rapidly that, after allowing for Cunard Eagle traffic, there is plenty of room for BOAC substantially to increase their present carryings so that the effect of diversion will progressively and rapidly diminish.
- "**In addition to the possible** generation of new traffic, the advent of Cunard Eagle is bound to attract some traffic from foreign carriers."

Because of the conclusions, the board left the door open for an eventual second flag on the U.K.-Canada route, saying: ". . . it should not be inferred that we should necessarily refuse to license a second United Kingdom carrier on a route where the traffic is no greater and growing no more rapidly than between the United Kingdom and Canada.

"For example, the traffic pattern and operating conditions on other routes might be very different from those on such long-haul routes as can be serviced by a few large, fast and very expensive aircraft."

Both BOAC and Cunard Eagle have made substantial investments in new aircraft, but it is far too soon to ascertain what impact the board's decision will have on these orders.

For instance, BOAC has ordered 15 Vickers VC.10s and 30 Super VC.10s and, during the hearings, said "if an independent comes in, the aircraft will be redundant and future profits jeopardized" (AW May 29, p. 35). On the other hand, Cunard Eagle has bought two Boeing 707-420s, with option on a third, and currently says that the case of buying the optional airplane is "very strong."

Another factor clouding future purchases is the fact that Cunard Eagle will not start service until May, 1962, on a one-a-day run to New York and return, and the impact of this service cannot be measured for some time. For instance, under the new license, fares will be those established by International Air Transport Assn. and Cunard Eagle must depend on an intensive sales campaign aimed at scheduling and personal service.

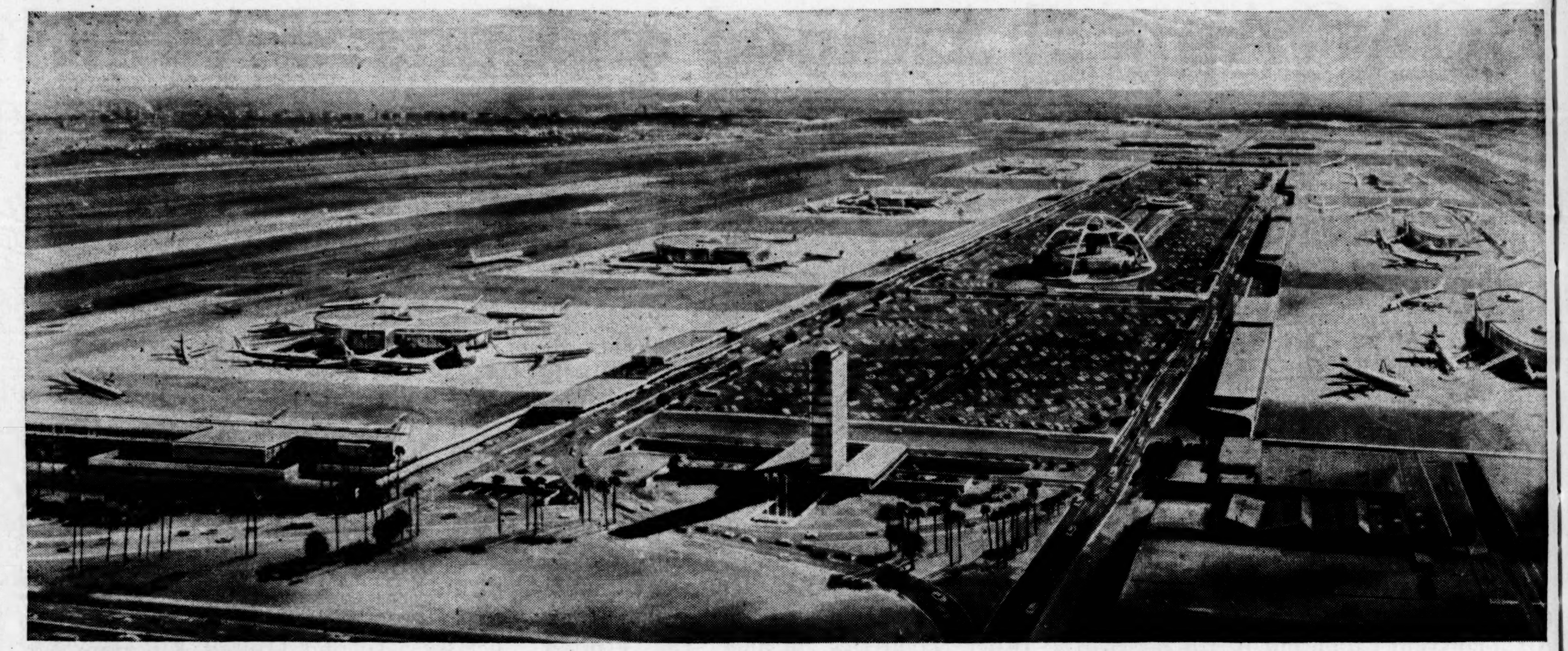
In discussing Cunard Eagle's financial backing, a strong point of controversy during the hearings and in Parliament, the board pointed out that "we are in no doubt that the assets of the Cunard Steamship Co. are adequate.

"We do not regard the Cunard Steamship Co.'s unwillingness to bear the whole cost and risk of replacing the Queen Mary as relevant to their ability and willingness to support the service now being licensed."

Cunard Opposition

London—British Labor Party plans to protest the Air Transport Licensing Board decision to allow Cunard Eagle to fly the North Atlantic.

The party previously has attacked Cunard Steamship, Ltd.'s, air venture in view of requests by the company for loans and subsidies to build a new Queen ocean liner. Protests probably will be made during final debates on the North Atlantic Shipping Bill.



ARTIST'S CONCEPTION shows how Los Angeles Airport jet terminal will look when it reaches completion.

Work Advances on Los Angeles Jet Airport

By Russell Hawkes

Los Angeles—First unit of the new passenger terminal at Los Angeles International Airport will be operational about July 15. Additional buildings are scheduled for completion in August and December, and another by 1962.

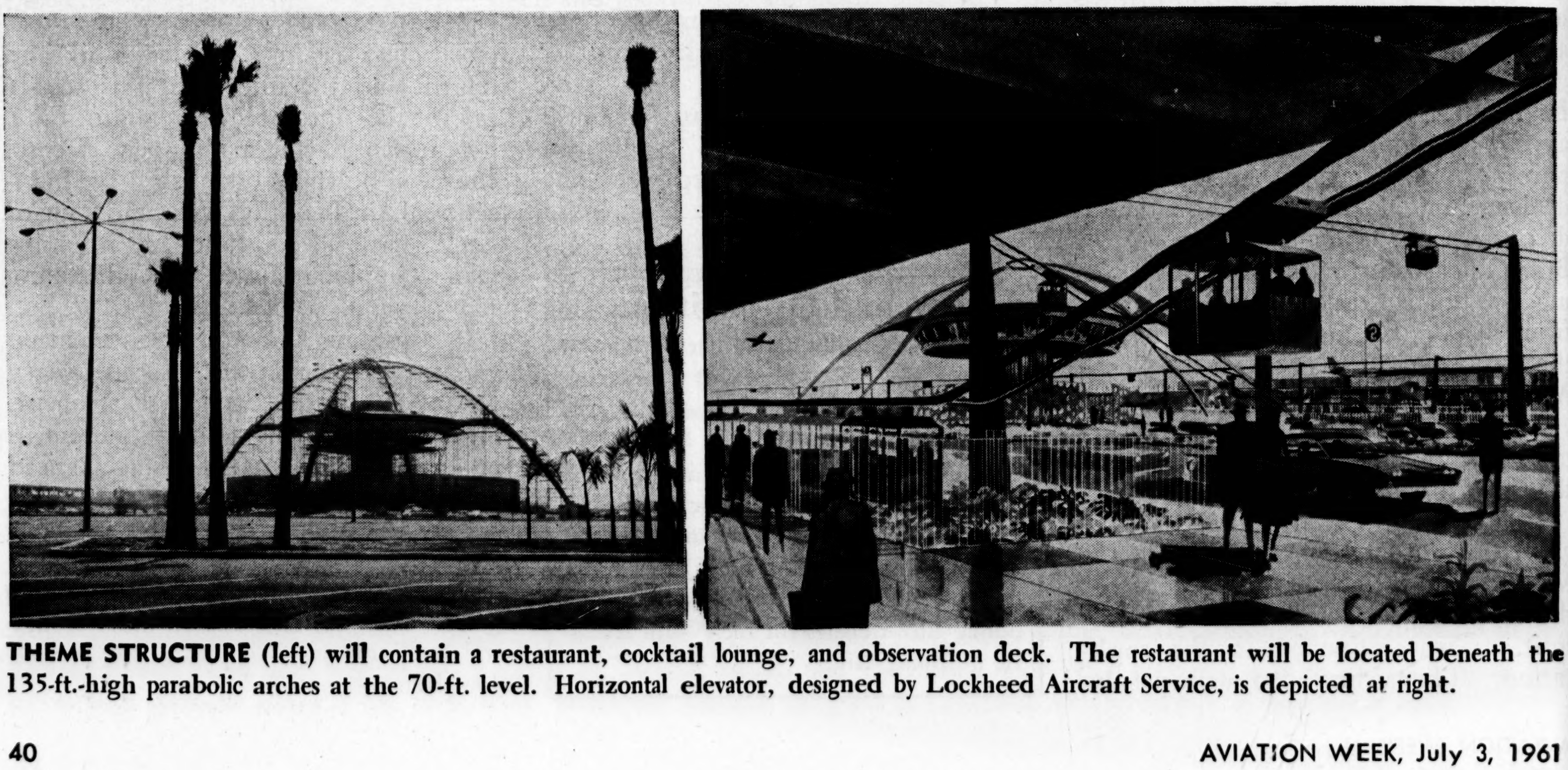
The new installation is arranged in a series of satellite terminals and ticketing buildings surrounding a parking area and a central service and administrative area. The first completed unit includes Satellite No. 7, Satellite No. 8, and the ticketing building serving them. The three buildings make up the new United Air Lines terminal in Los Angeles. United runs more flights through Los Angeles International than any other line and is the only one to be assigned two satellites.

Satellites No. 3, No. 4 and No. 5 are to be completed in August and will be used by Trans World Airlines, American Airlines and Western Air Lines. Satellite No. 2 will belong to international carriers and will house the customs area and facilities of the Immigration, Public Health and Agriculture departments. It is scheduled to be complete by December. Construction of Satellite No. 6 will begin shortly and should be completed by December, 1962. It will be used by the regional carriers with service to Los Angeles.

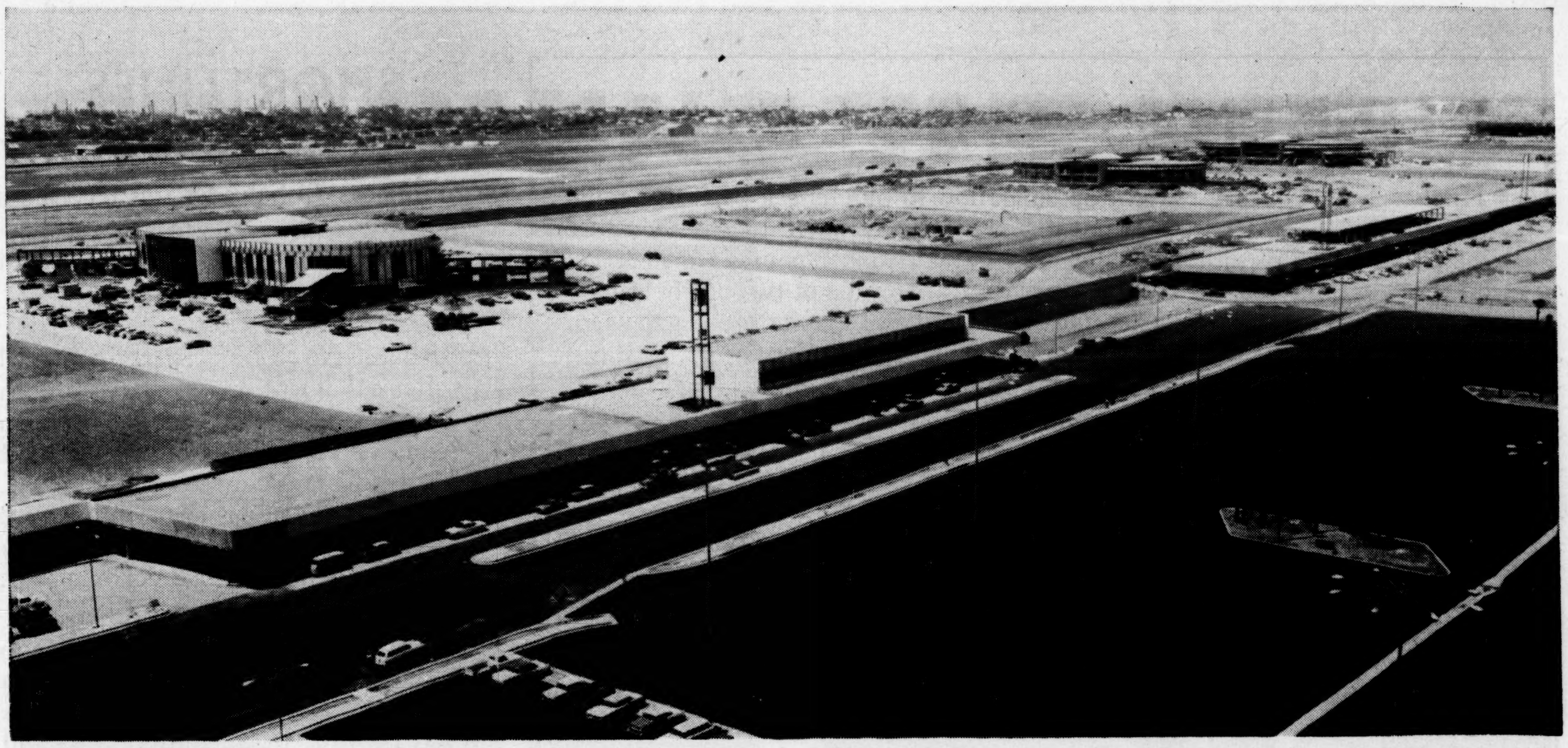
As yet there are no firm plans to build Satellite No. 1. Its place will be left vacant until a need for it arises. There is room for more satellites beyond the end of the present quadrangle if the facilities must be expanded. The terminal area now being opened will have 72 gate positions.

A 12-story administrative building with the control tower cab on top of it has already been occupied and the control tower operators will move to the new location in mid-July. The new tower is 172 ft. high. Los Angeles Department of Airports had to obtain a special waiver for the tower from Federal Aviation Agency since it exceeds the maximum height specified by regulations. The field boundary is only about a mile from the beach, so Los Angeles International is vulnerable to coastal fog. Since the tower is responsible for surface traffic as much as two miles away, airport surface detection radar will be essential before the new tower can start operations.

Operator positions line both the north and south sides of the control tower cab because of the peculiar layout of the airport. There are two east-west runways to the south of the tower and



THEME STRUCTURE (left) will contain a restaurant, cocktail lounge, and observation deck. The restaurant will be located beneath the 135-ft.-high parabolic arches at the 70-ft. level. Horizontal elevator, designed by Lockheed Aircraft Service, is depicted at right.



MAIN STRUCTURES in United Air Lines' portion of terminal are ticketing building (center) and Satellite 7 directly behind it.

the new terminal area and one other to the north. There is also a short north-south runway. A fourth east-west runway is projected. The prevailing winds are from the west and the airport was designed with the idea of using two parallel runways to handle landing aircraft and two others for takeoffs.

Cost of the modernization program being concluded this year is set at $200 million counting federal aid, a $59.7-million municipal bond issue, and an investment of $100 million by the airlines and other airport tenants. The 3,000-acre airport is claimed to be a self-supporting agency with operating costs, bond redemption and interest being paid for by airport revenues. Revenues for 1959-60 totaled $5.71 million. The airport has, at present, 145 leaseholding tenants.

Don Belding, head of the Los Angeles Airport Department, told Aviation Week that the old terminal area, east of the new one, will be turned into an air cargo terminal during the next four or five years. The U. S. Post Office has already announced its intention to build a large new air mail center in the parking area of the old terminal, Belding said.

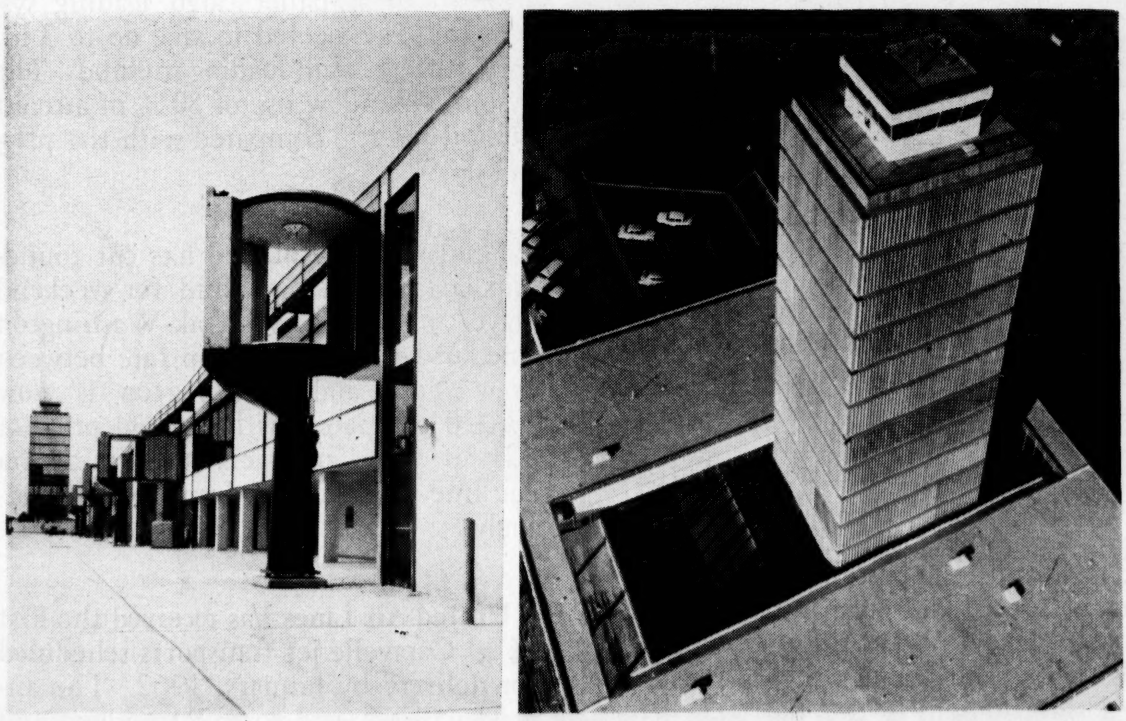
In the more distant future, the city hopes to obtain another airport in the outlying deserts which would handle cargo and overflow from International Airport. The future of this plan depends on getting good surface transport between the city and the new airport.

No opportunity to use the new international airport terminal complex as a promotional device for Southern California is being neglected. Each satellite building will have its own restaurant and cocktail lounge and the decorative schemes are to be based on such motifs as California desert, beach and mountain recreation areas.

Much attention is being paid to the caliber of service supplied by airport employes and the businesses functioning in and around the terminal area. Before the opening of the first of the satellite terminals, the Department of Airports conducted an unprecedented training program for more than 5,000 people, including the personnel of nearby motels. The purpose of the program is to make sure that anyone working at the airport or serving airline customers elsewhere can provide information on the services and facilities available at the airport. A staff of airport guides who are ex-airline stewardesses is being employed to provide assistance to the traveler.

The wheel-like layout of the airport is intended to cut down the time and walking distance needed for the passenger to reach his airplane. The main parking area is located in the center of the 256-acre terminal complex. It is 14 ft. below field level so that it can be decked over to double the parking area as traffic grows. A coin-operated chairlift carrying cabs of four passengers with baggage on overhead cables is being designed for the airport by Lockheed Aircraft Service to provide transportation around the circle of ticketing buildings surrounding the parking lot.

Baggage collected at the ticketing buildings will be marked with tags bearing a magnetic code symbol for the passenger's destination. A system of conveyors will then carry the baggage through underground tunnels to the satellite where it will be loaded. The passenger will get to the satellite through a 400-ft. underground concourse.



ROTATING CABS or rotundas for telescoping jetways along ramp side of Satellite 8 are visible at left. Control tower (right) is 172 ft. high.

AIRLINE OBSERVER

▶ Hughes Tool Co. may have some obligation to purchase a part of Capital Airlines' original order for seven Convair 880M turbojet transports. Two aircraft built on this order have been leased to Swissair pending delivery of Convair 990s, and Convair has prospects for lease or sale of two more, leaving three aircraft from the Capital order uncommitted. Capital canceled when Vickers-Armstrongs sued over Viscount payments, but Convair went ahead with production. When Hughes agreed to release six of its order for 30 Convair 880s for lease to Northeast Airlines, Howard Hughes reportedly signed a letter of intent for the Capital 880Ms. How far Hughes is bound is still in dispute.

▶ Sud Aviation, trying to sell medium-range Caravelle jet transports to Trans World Airlines, is offering TWA a number of Mark VI R versions powered by two Rolls-Royce Avon turbojets until it can deliver later Mark VII models equipped with General Electric CJ805-23 turbofans. TWA is pushing for early delivery dates on any order it may place to gain maximum advantage from the Caravelle on domestic routes before the appearance of the Boeing 727 medium-range transport. If TWA does lease the Caravelle VI R, the carrier is expected to approach United Air Lines, which has 20 on order, to handle maintenance of the French aircraft.

▶ Watch for an order by Japan Air Lines for a seventh Douglas DC-8 turbofan transport within the next few months. Order for a sixth DC-8 was placed late last month (AW June 26, p. 37). JAL was negotiating for purchase of Northwest DC-8s, but decided against this move.

▶ Trans World Airlines has asked the Civil Aeronautics Board for authority to suspend its service at Bangkok and Colombo because of high operating losses at these two points. Carrier said it would resume the service when its amended certificate extending its Far East route into Hong Kong, which has been stayed by the Board in the Transpacific Route Case, becomes effective.

▶ Soviet consideration of a limited order for Sud Caravelle medium-range transports reportedly revolves around a total of three aircraft. The visit of a Russian delegation to Sud's Toulouse production facility (AW June 26, p. 39) was followed by a request from the Soviet Embassy in Paris for additional information. Sud complied with technical and performance details, plus available delivery dates. Purpose of such an order, if it should come through, is still unknown. The Soviets are believed to want the aircraft primarily to compare with their own techniques and equipment.

▶ Brazil will arrange talks with United Arab Republic to establish an experimental Rio de Janeiro-Cairo route for Panair do Brasil.

▶ Civil Service Commission has authorized a grade increase for air traffic controllers assigned to control towers and air route traffic control centers. Number of positions which will be raised one grade will not be determined until an analysis of each position has been completed. Chiefs, supervisors and certain controllers performing such functions as radar control will be primarily affected. Trainee and assistant controller grades will not be increased.

▶ Federal Aviation Agency will release information it receives on failures of equipment operated by commercial airlines if such information will help improve safety. Policy in the past has been to withhold operating malfunctions from the public.

▶ Russia is beginning to divert some of its early-model, twin-turbojet Tu-104 transports from passenger configuration to cargo-mail transports. The Tu-104s, with their high seat-mile costs, are being replaced by more efficient Il-18 and An-10 turboprop aircraft and 100-passenger Tu-104Bs. Most of the Tu-104 mail-cargo flights will originate in Moscow, where friction has developed between Aeroflot, which wants to improve on-time performance, and Soviet postal officials, who want regular flights delayed if necessary for high-priority shipments. Establishment of the Tu-104 schedules is expected to benefit both sides in the squabble.

SHORTLINES

▶ **Aerolineas El Salvador** has received a temporary foreign air carrier permit allowing it to operate between El Salvador and Miami for three years.

▶ **Bonanza Air Lines** is asking Civil Aeronautics Board approval of a Youth Fare plan allowing passengers between the ages of 12 and 21 to travel at half the first-class fare between certain cities. To be eligible, a passenger must give proof of age and purchase a $2 identification card which is good for one year.

▶ **Federal Aviation Agency** is photographing the landings of jet transports at five major airports to establish a basis for FAA approach and landing rules and for determining airport size. The photos show the aircraft's angle of approach, rate of descent, the spot where the wheels touch and the rate of deceleration.

▶ **International Civil Aviation Organization** has voted to increase its council from 21 to 27 member nations in an effort to provide better geographical representation (AW June 26, p. 52). The decision must be ratified by two-thirds of the member nations.

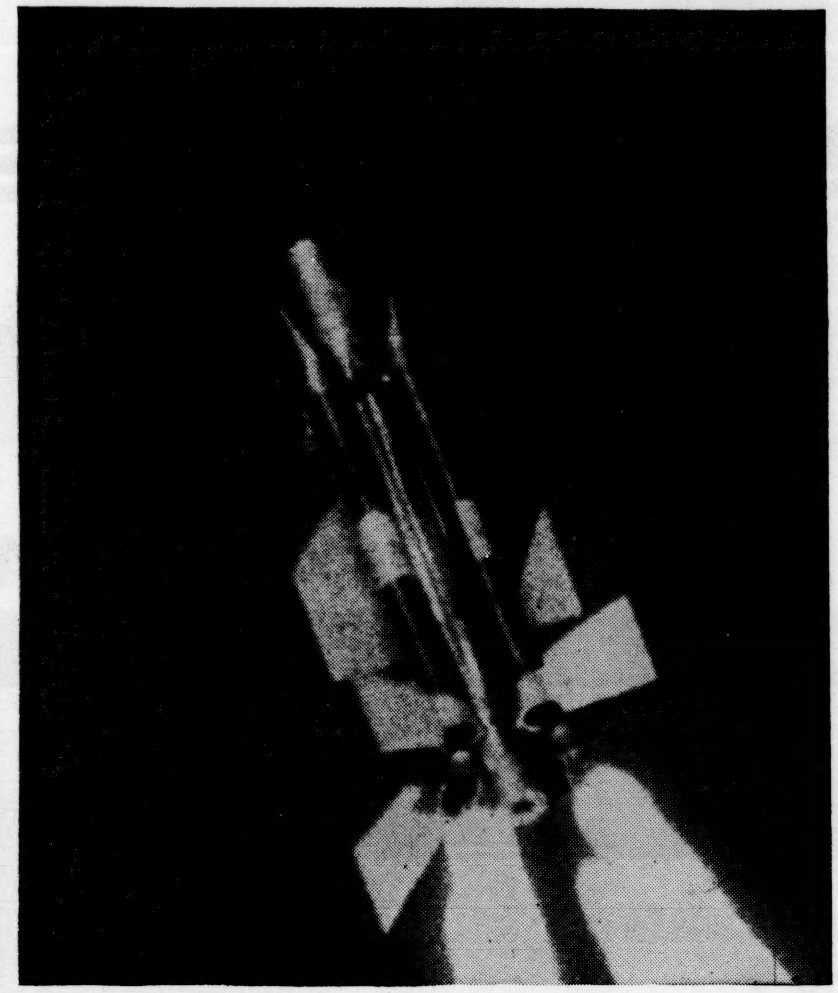
▶ **Lord Douglas of Kirtleside** has accepted the invitation of the British Minister of Aviation to continue as chairman of British European Airways until Dec. 23, 1963, his 70th birthday. Lord Douglas was named BEA chairman in 1949.

▶ **Pan American World Airways** has started converting its DC-7CF cargo fleet to an all-pallet cargo loading system that is expected to save up to 3 hr. over current hand-loading methods. The system will allow use of 80% of aircraft cubic capacity, compared with the present 50%.

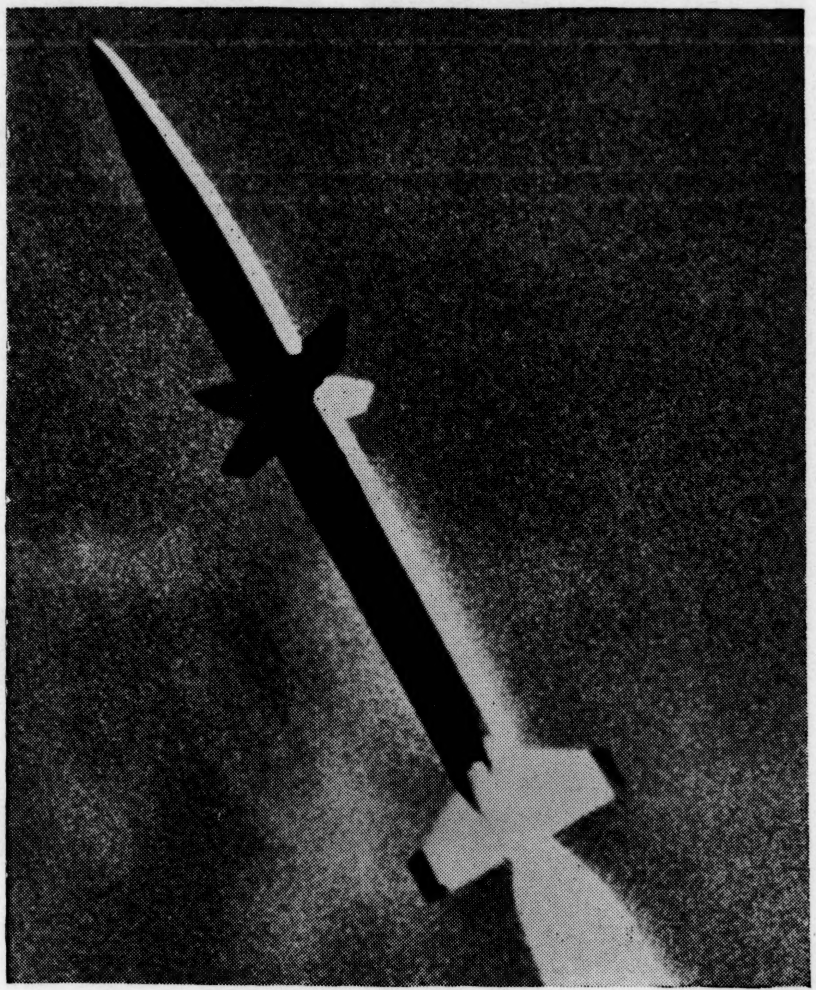
▶ **Pennsylvania Railroad** has cut round-trip coach fares one third for weekend travel on its New York-Washington line. Weekend round-trip fare between New York and Washington is now $14.20 compared with the old price of $21.30. Fares between other points on the line have been reduced correspondingly.

▶ **United Air Lines** has received the first of 20 Caravelle jet transports scheduled for delivery by January, 1962. The aircraft will be used for pilot and ground crew training before going into scheduled service later this summer.

RE-ARMING THE ARMY



THUNDERBIRD
The lethal, accurate and highly mobile anti-aircraft missile in service with the British army.



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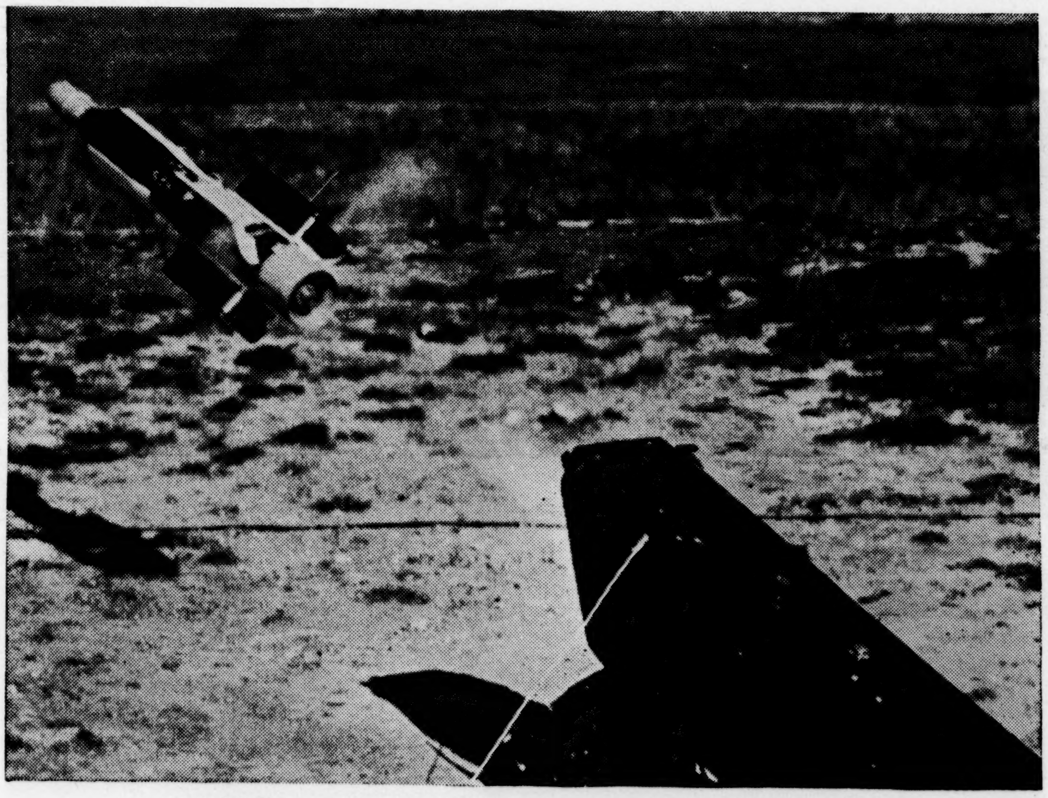
BLUE WATER
The new surface-to-surface missile being developed for the British army.



VIGILANT The one-man wire-controlled anti-tank missile now on service trials with the British army.

. . . and all built by
BRITISH AIRCRAFT CORPORATION

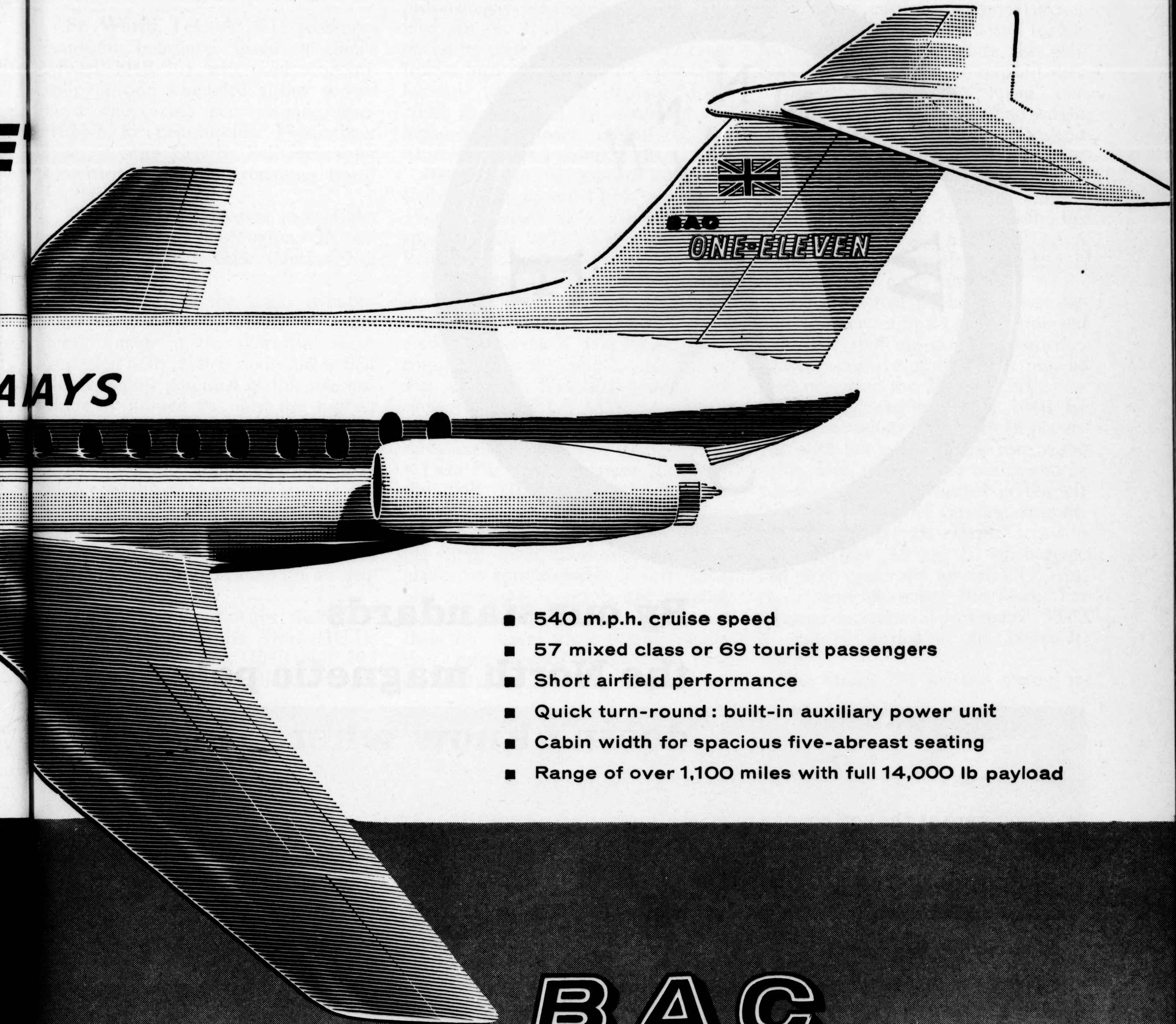
ONE HUNDRED PALL MALL LONDON SW1

BRITISH UNITE
CHOOSES
THE SHORT HAUL JE

BRITISH UNITED A

JET SUCCESSOR TO THE VISCOUNT
WITH EVEN BETTER THAN VISCOUNT ECONOMICS

AIRWAYS



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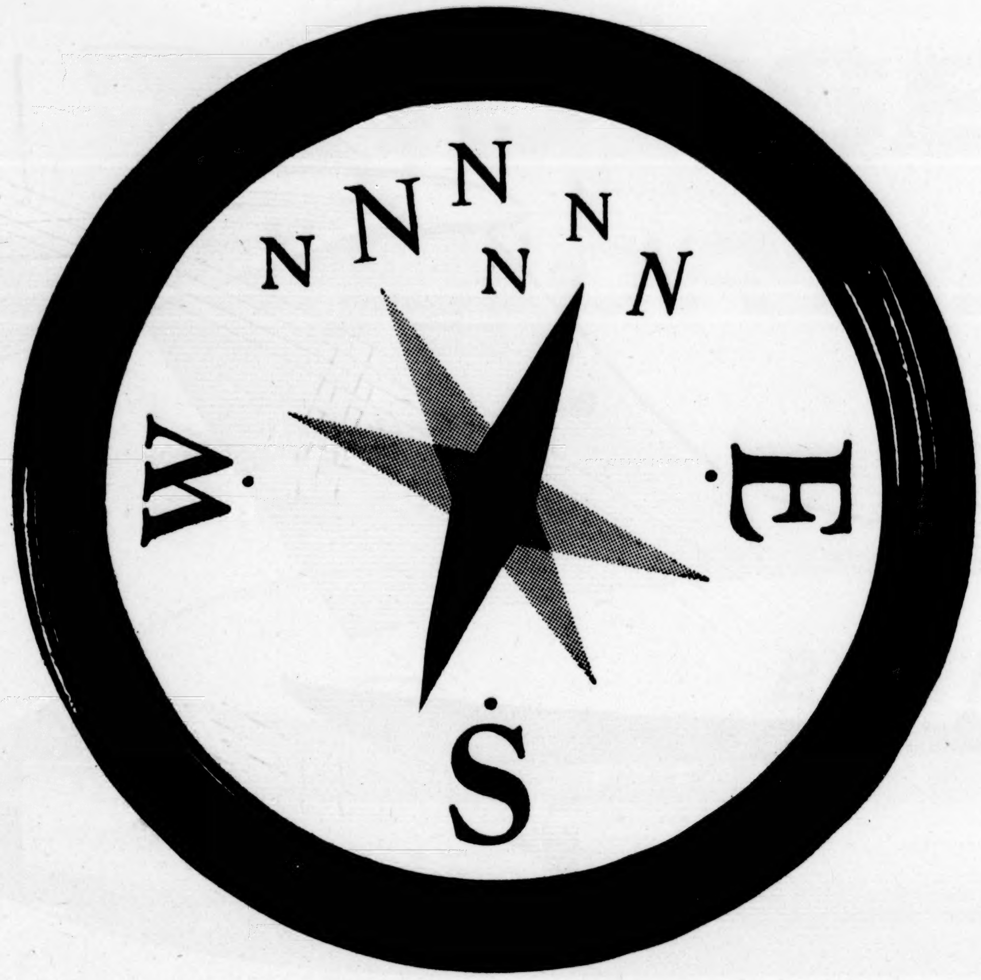

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If you were at the bottom of a mine-shaft, or in unsurveyed country on a cloudy day, and you had to find true North with high precision, we could help you. We wouldn't use a magnetic compass, which is not nearly sensitive enough, or the Astronomer Royal, who would insist on having a clear view of the sky. We would use one of our fantastically accurate and sensitive floated Gyroscopes. And the job would be done while you waited, to an accuracy of a few minutes of arc.

This is but one of the several complete systems we are working on, taking as our starting point the Gyroscopes we make in partnership with Minneapolis Honeywell and grafting on to them all the arts and skills of the computer designer and the electronics engineer. And we believe we've only scratched the surface of the capabilities and versatilities of Gyroscopes so accurate that they precess barely a degree per *day*, and so sensitive that they respond to a rate of rotation of one revolution in many *years*.

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Bell Computes 204-Type Airliner Costs

By Erwin J. Bulban

Ft. Worth, Tex.—A 10-15 passenger transport helicopter based on Bell's Model 204B/205 series can economically provide scheduled airline service at a direct cost per seat-mile comparable to twin-turbine 25-passenger types, a brief filed by Bell Helicopter Co. with the Civil Aeronautics Board contends.

The brief is planned as part of the record in the Washington, D. C. Helicopter Service Case (Docket No. 11941, et al).

Admitting that the larger twin-turbine helicopters represent a major breakthrough in the short-haul transportation market, Bell's position is that the economic potential of this size machine is limited to only the highest traffic density markets and that the smaller rotary wing transport not only lends itself to supplementing these bigger machines to provide greater frequencies, but also lends itself toward expansion of route structures by serving less-heavily traveled areas at sufficient frequency to build volume on an economical basis.

The company estimates that commercial versions of its Army HU-1B and HU-1D (Models 204B and 205 respectively) can reduce direct cost per seat-mile from 25% to 60% under any piston-engine helicopter now in scheduled service. It also states that direct operating costs per seat-mile will range from a high of 6.4 cents for an average five-mile hop for the 10-place Model 204B to a low of 6.1 cents for the high-density 15-seat version of the Model 205 over a 75-mi. flight.

Both models, in standard configurations, can be operated over a route of 15-mi. segments at a direct cost of approximately 10-11 cents per seat-mile, Bell reports.

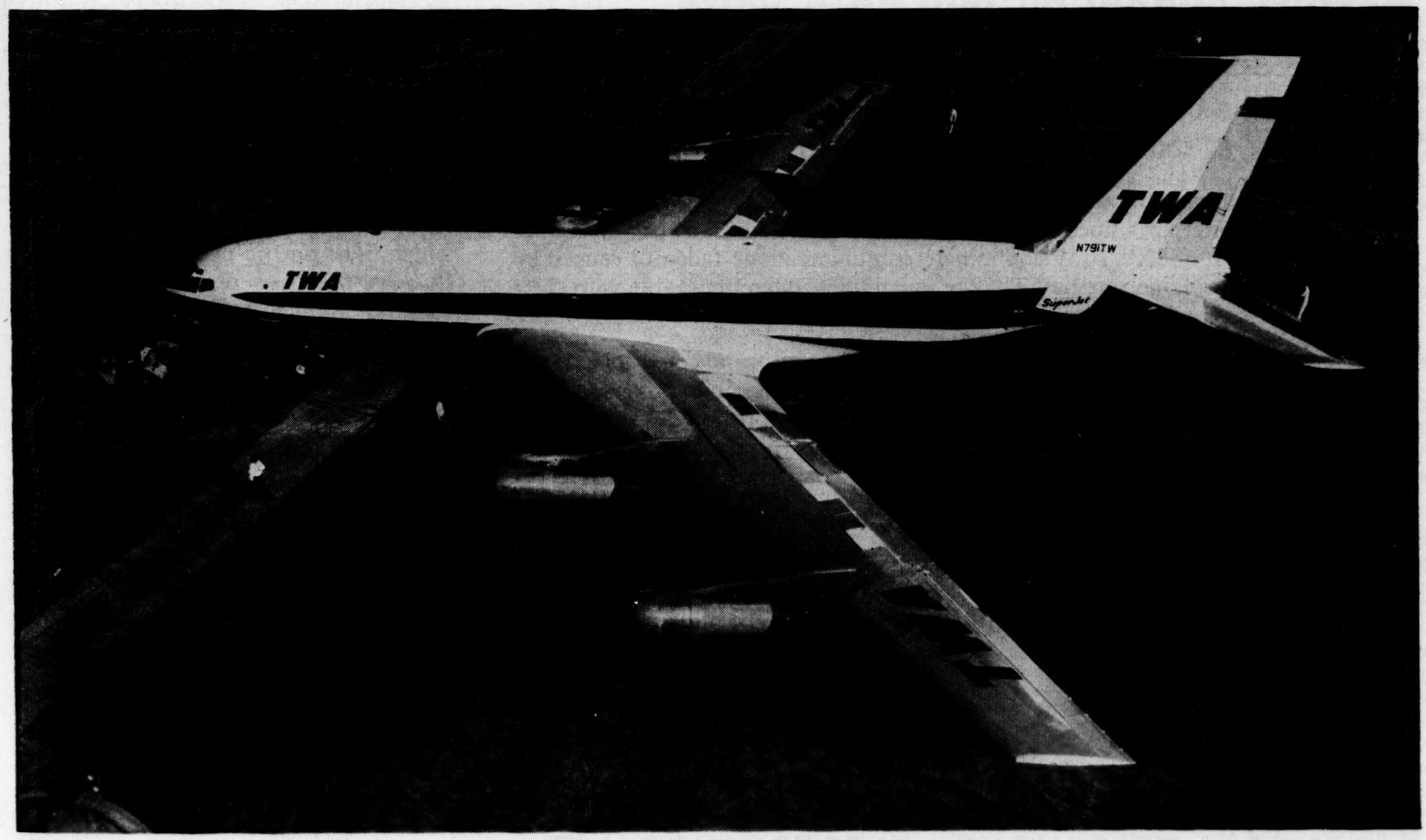
Design growth of the single-turbine model 204B/205 is such that twin-engine configurations may be considered, Bell revealed, with engine costs comparable to the current single 1,100-shp. Lycoming LTC1K-2, civilian version of the T53-L-9 (AW Apr. 24, p. 34). Highlights of the twin-engine versions include:

- **Twin P&WA PT6** layout for use in the 204B (HU-1B) could be mounted on the existing engine deck feeding through a common shaft into the existing 204B main transmission. Powerplants, at approximately 225 lb. each, plus accessories, controls and coupling gear box would weigh some 40 lb. more than the current single engine installation. Prices quoted by Canadian Pratt & Whitney are in the "neighborhood of $20,000 per engine," with production engines available in early 1963.
- **Twin Continental T72** layout for the Model 205 has the engines also positioned on the existing powerplant deck in parallel in contrast to "toe-in" configuration of the PT6s. Engine weight of 200 lb. each would provide a slight advantage over the PT6, Bell notes, and be very similar to the current single-engine installation. Continental is quoting a price of "substantially less than $20,000 each" for its T72. A military 150-hr. flight rating test is scheduled for next summer.

Bell notes that neither of these layouts represents a final configuration and that it is studying various approaches whereby either type of engine may be used on either the 204B or 205.

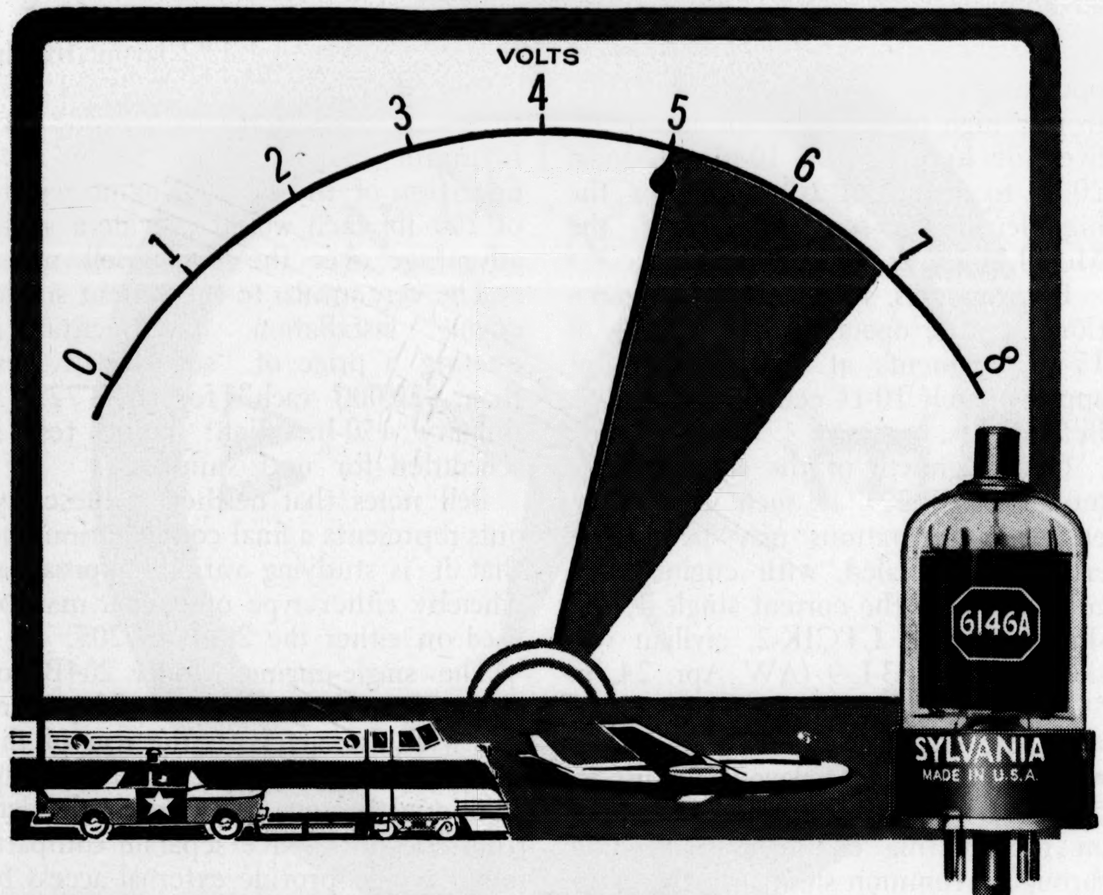
The single-engine Model 204B for airline operations could seat 10 passengers with five across in the rear of the cabin, four across in the center and an additional passenger seated in the left front cockpit. Three separate compartments would provide external access to approximately 30 cu. ft. of baggage and mail space and an extra 13.5 cu. ft. is available under the seats. For all-cargo operation, approximately 3,000 lb. can be carried in the 140-cu.-ft. cabin.

The Model 205 has two seating ar-



Trans World Airlines' 720B Prepared for Delivery

First of Trans World Airlines' 720B turbofan transports is shown after rolling out of Boeing's Renton, Wash., paint hangar. The 720B is powered by four Pratt & Whitney JT3D-1 turbofan engines each developing 17,000-lb. thrust (AW Mar. 20, p. 67). Aircraft is part of a four-plane lease order placed with Boeing by TWA (AW May 8, p. 39).



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*Minimum output limit for an individual tube (CCS) measured in a single-tube self-excited oscillator circuit. Conditions: plate voltage—600Vdc; grid #2 voltage—180Vdc; grid #1 resistor—30,000 Ohms; plate current—100 to 112mA; grid #1 current—2 to 2.5mAdc; frequency—15 MC.

Available from your Sylvania Industrial Tube Distributor

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GENERAL SYSTEM

rangements. An 11-passenger version, having two rows of five abreast and one in the left front cockpit seat, provides two 30-cu.-ft. internal baggage areas, with some 18 cu. ft. under the seats available. The high-density 15-passenger model would have two additional seats on either side at the rear of the cabin facing outward, in place of the baggage compartments. Bags could be stowed in an external pod under the fuselage. Pod installation would require a slightly higher skid landing gear, but this has already been done several times on military HU-1s to accommodate a variety of external stores.

At 6,500-lb. gross weight, the aircraft could cruise at 126 mph. at sea level with an endurance of 1.8 hr., a range of 234 mi. and best rate of climb of 2,857 fpm. At 8,500-lb. gross weight, sea-level cruise speed is estimated at 109 mph., range at 209 mi. and best climb rate at 1,660 fpm. Model 204B empty weight is calculated at 4,454 lb. and the 205's at 4,418 lb.

To ascertain operating costs, Bell chose to superimpose the Model 204B/205 on an actual operating environment considering Chicago Helicopter Airways' system as being very similar to the Washington, D. C.-Baltimore-Dulles International Airport triangle. Direct operating costs of 11 cents per seat-mile are calculated for the 204B based on the average 14.8-mi. Chicago Helicopter Airlines stage length, with the Model 205 operated at 10.3 cents per seat-mile in its standard 11-passenger configuration. The 15-passenger version would experience direct operating costs of 7.6 cents per seat-mile, the manufacturer estimates.

Because of the weight category—the Model 204B/205 being less than 12,500 lb. gross—Bell considered using only a single pilot on the operation, and notes that on the basis of CHA's pilot contract as applied to copilot compensation, there was a saving of 1.6 cents per seat-mile compared with using a two-man crew.

In computing Bell Model 204B capital costs, the manufacturer reports that a fleet of six aircraft would total some $1.8 million—with recommended spares for this number of aircraft the total investment would be some $2,178,000. The same number of Model 205s would total approximately $1,980,000 and with recommended spares, capital investment would run $2,358,000.

A single Model 204B, on the basis of a 2,000 daily passenger market, Bell states, would operate 2½ times as frequently between two points as one 25-passenger turbine helicopter or it would serve five points with the same frequency while the larger equipment was serving only two. The smaller equipment also is more readily useful in adjusting to peak and slack periods.

Airline Income and Expenses—First Quarter, 1961

(IN DOLLARS)

	Passenger Revenue	U. S. Mail	Property*	Charter	Federal Subsidy	Total Operating Revenues	Total Operating Expenses	Net Income Before Taxes
DOMESTIC TRUNKS								
American	78,999,711	1,936,918	7,098,712	246,116	....	89,647,613	92,602,783	−3,837,461
Braniff	16,596,266	490,053	1,016,385	58,017	....	18,049,714	18,172,369	−412,641
Capital	24,057,431	635,405	1,088,782	22,219	....	24,742,037	27,355,801	−3,292,860
Continental	13,957,871	280,653	642,579	53,288	....	15,052,277	13,929,903	351,672
Delta [2]	37,092,056	697,781	1,820,355	12,504	....	39,780,752	35,331,439	3,752,248
Eastern	59,494,376	1,395,504	2,897,467	397	....	64,205,368	69,721,132	−6,245,300
National	15,705,704	305,438	1,013,581	147,705	....	17,366,626	17,997,960	−1,052,329
Northeast	12,606,284	180,592	554,479	13,647	....	13,419,069	14,197,464	−1,285,755
Northwest	5,430,465	148,701	384,286	36,595	....	8,479,971	10,155,397	−1,791,713
Trans World	51,680,050	1,362,940	3,839,193	320,877	....	58,378,441	65,942,426	−10,733,751
United	85,052,859	3,858,142	7,321,247	130,034	....	95,425,900	96,135,577	−2,072,148
Western	9,316,968	188,893	425,542	137,467	....	10,129,092	11,323,068	−848,181
INTERNATIONAL								
American	1,189,909	10,439	197,784	....	....	1,457,156	1,801,711	−345,250
Braniff	2,317,057	71,740	262,056	....	....	2,680,218	3,131,676	−514,005
Caribbean Atlantic	928,820	9,051	46,812	13,296	....	1,023,323	861,746	162,793
Delta [2]	....	....	....	....	....	....	....	....
Eastern	7,860,892	166,490	399,147	....	....	8,042,077	7,820,073	168,549
Mackey	528,316	....	23,871	9,317	....	565,410	506,689	58,782
National	56,001	115	3,454	....	....	59,863	110,512	−50,649
Northwest	3,540,792	1,782,410	681,745	62,612	....	6,513,810	5,785,154	480,374
Pan American Combined	62,657,386	7,477,174	10,787,222	3,945,140	....	87,278,101	98,490,589	−13,232,910
Alaska	747,351	47,152	99,446	894,202	....	907,441	1,423,611	−526,545
Atlantic	24,788,655	3,260,985	4,067,208	1,299,941	....	34,263,368	43,678,359	−8,224,646
Latin America	18,278,284	584,506	3,459,454	199,495	....	23,332,665	26,513,655	−3,103,350
Pacific	18,843,096	3,584,531	3,161,114	2,445,803	....	28,774,641	26,854,194	1,769,412
Panagra	3,775,898	181,177	789,664	....	....	5,118,013	5,555,694	−514,864
Resort [3]	....	....	....	....	....	....	....	....
Trans Caribbean	336,247	....	51,109	6,653	....	414,356	433,313	−18,278
Trans World	7,779,929	1,778,954	1,553,899	644,890	....	12,546,296	17,894,394	−5,944,626
United	4,664,007	281,725	160,523	....	....	5,126,967	3,841,221	1,178,100
Western	640,513	7,243	23,457	....	....	679,462	961,939	−304,975
LOCAL SERVICE								
Allegheny	2,514,108	80,981	152,440	165	1,498,362	4,270,427	4,883,227	−571,713
Bonanza	1,429,873	13,310	41,278	2,393	780,346	2,281,829	1,917,409	327,400
Central	634,449	19,489	40,579	22,582	760,540	1,485,624	1,491,044	−11,163
Frontier	1,756,521	61,144	112,242	9,177	1,515,880	3,482,602	3,321,695	124,037
Lake Central	917,064	20,279	42,561	1,822	799,947	1,783,100	1,768,103	−7,849
Mohawk	2,542,978	68,064	103,554	64,976	991,956	3,811,722	3,762,237	−81,892
North Central	3,506,732	109,854	205,553	6,114	1,949,131	5,796,874	5,899,867	−164,707
Ozark	1,865,709	58,086	114,948	9,607	1,104,036	3,169,272	3,055,552	71,444
Pacific	1,406,112	34,617	33,121	176,497	954,626	2,611,046	2,502,003	22,072
Piedmont	1,602,976	28,223	65,711	44,561	1,001,203	2,799,270	2,955,171	215,368
Southern	1,234,132	48,805	61,973	12,948	1,004,690	2,370,578	2,416,109	44,703
Trans-Texas	1,230,539	40,388	71,087	11,898	853,815	2,217,209	2,194,060	4,889
West Coast	1,634,584	34,422	48,744	7,057	1,304,796	3,044,245	2,761,102	226,946
HAWAIIAN LINES								
Aloha	1,043,045	6,241	18,232	423	53,426	1,155,378	1,242,324	−165,885
Hawaiian	1,325,021	9,845	218,734	236,834	51,538	1,888,217	2,120,172	−292,896
CARGO LINES								
AAXICO	....	....	....	....	....	106,721[4]	63,015	74,304
Aerovias Sud Americana [1]	....	....	....	....	....	....	....	....
Flying Tiger	....	49,531	2,652,019	3,657,043	....	6,417,749	6,264,455	−4,071
Riddle	....	52,602	1,135,421	1,686,007	....	2,890,737	3,036,646	−190,911
Seaboard World	....	1,415,333	2,053,099	352,140	....	3,873,136	4,877,792	−1,186,417
Slick	....	....	....	1,984,481	....	2,016,116	1,898,939	73,506
HELICOPTER LINES								
Chicago Helicopter	349,729	8,345	2,464	350	386,198	747,761	847,101	−100,707
Los Angeles Airways	56,768	41,644	37,012	37	263,170	399,208	385,110	17,420
New York Airways	230,248	12,077	16,826	6,696	569,130	838,763	932,895	−100,615
ALASKA LINES								
Alaska Airlines	585,665	181,986	123,484	661,780	498,096	2,129,230	2,098,839	32,487
Alaska Coastal	178,401	25,962	25,947	6,944	237,465	479,341	488,389	−15,878
Cordova	30,486	29,191	31,523	58,325	140,934	292,010	268,045	20,367
Ellis	102,076	11,160	12,752	2,027	133,434	261,839	334,326	−73,116
Kodiak	35,863	2,726	5,403	3,996	9,379	57,670	65,968	−5,674
Northern Consolidated	156,239	178,721	89,042	16,345	256,205	702,955	771,265	−102,601
Pacific Northern	1,461,380	280,567	335,826	16,829	581,450	2,694,764	2,774,454	−93,230
Reeve Aleutian	330,500	119,461	108,037	29,270	....	601,499	550,028	51,836
Western Alaska	16,156	5,362	3,101	8,876	22,960	56,323	66,294	−10,890
Wien Alaska	134,056	148,496	77,714	66,780	523,763	956,840	978,069	54,082
Avalon Air Transport	45,215	4,116	1,576	12,511	....	63,754	118,200	−56,044
Samoan [1]	....	....	....	....	....	....	....	....

[1] **Not available.** [2] **Trunk income and expenses include international business.** [3] **Operations suspended.** [4] **Non-transport revenues.**

*** Property figures contain freight, express and excess baggage revenues.**

Compiled by AVIATION WEEK from airline reports to the Civil Aeronautics Board.

LABORATORY LAUNCH PAD

"In-house" missile flights are a daily occurrence at Lockheed Missiles and Space Division. The advantages of "flying" the POLARIS FBM inside the laboratory, on an amazing internally-developed simulator, are obvious.

The simulator performs many developmental and test functions. When the missile is first conceived, performance characteristics are cranked in; basic overall requirements are read out. Later, the simulator details the functional requirements of each subsystem and calculates specifications for hydraulic, electronic and pneumatic hardware. As each component is built, it replaces its computer counterpart.

Finally, the whole guidance and flight control package is put through simulated flights for final checkout. But that isn't all. The simulator also performs the role of post-flight evaluation detective when it is fed tapes of actual flights, and the effects are observed on earth-bound hardware.

It is with such elaborate equipment, guided by engineers and scientists of outstanding calibre, that Lockheed Missiles and Space Division has attained its place in the forefront of missile and space technology. And such progress is constantly creating key positions for other engineers and scientists of proved ability, so they may take up the exciting challenges offered by Lockheed and share in its rewards.

This unusual organization is located in Sunnyvale and Palo Alto, on the San Francisco Peninsula in California. For an informative brochure, "Your Place in Space," write to: Research and Development Staff, Department M-31B, 962 West El Camino Real, Sunnyvale, California. U.S. citizenship or existing Department of Defense industrial security clearance required. All qualified applicants will receive consideration for employment without regard to race, creed, color, or national origin.

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Systems Manager for the Navy POLARIS FBM and the Air Force AGENA Satellite in the DISCOVERER and MIDAS Programs

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Gardner Analyzes U.S. Lunar Race Plan

This analysis of the factors involved in a national effort to land men on the moon before Soviet Russia was presented recently by Trevor Gardner before a joint meeting of the Institute of Aerospace Sciences and the American Rocket Society in Los Angeles. Aviation Week *is publishing the complete text of Mr. Gardner's speech because of industry's interest in this important new program—Ed.*

Achievements in space have created a new international index of our nation's position in world leadership. Our allies, the uncommitted nations and the emerging new nations watch this index. The USSR clearly recognizes this fact. The President of the United States also clearly recognizes this fact. He has recommended to the Congress that the U. S. establish a major national goal of landing a man on the moon and returning him safely to earth before the end of this decade.

What is not clear, however, is that the urgency and implications of achieving this goal are understood and accepted by all Americans. The total reaction of the United States to the challenge and opportunity of space in the three and one-half years since Sputnik I has been a sad and repetitious story of too little, too late.

It is true that we have achieved some scientific and military progress, but not enough to prevent great damage to our image of world leadership. Our recent successes do not materially alter these facts.

Reversing the Trend

Unfortunately, our society has a consistent record of having under-imagined the possibilities of the technological future, and of having under-reacted to the ominous significance of Soviet technological and military progress—in nuclear and thermonuclear weapons, in military aviation, in intercontinental missiles, and in space developments. The President's proposal for our future in space is a dramatic, necessary and timely reversal of this trend. He now offers us the leadership and the opportunity to erase the familiar phrase, "we are behind," from the blackboard of time.

On May 25, 1961, in a special message on urgent national needs, the President requested the Congress to provide funds necessary to achieve a new national goal which he described as follows:

"I believe that this nation should commit itself to achieving the goal, before this decade is out, of landing a man on the moon and returning him safely to the earth. No single space project in this period will be more impressive to mankind, or more important for the long-range exploration of space; and none will be so difficult or expensive to accomplish." He further said:

"Let it be clear—and this is a judgment which the members of Congress must finally make—let it be clear that I am asking the Congress and the country to accept a firm commitment to a new course of action—a course which will last for many years and carry very heavy costs of $531 million in Fiscal 1962—an estimated seven to nine billion dollars additional over the next five years. If we are to go only half way, or reduce our sights in the face of difficulty, in my judgment it would be better not to go at all."

This daring and courageous commitment by the President and his request for support by the people and the Congress is a clear recognition of the fact that in the field of science and technology a mortal struggle for supremacy and survival has long been in progress. This decision in the nuclear space age is a haunting echo of a similar decision made by another President of the United States in a world at war in the manned aircraft, gunpowder age—the decision of Franklin Delano Roosevelt to request the Congress for authority to build 50,000 planes a year to meet the Nazi horror.

Throughout the detailed language of his proposal, President Kennedy provides us with renewed hope, confidence and conviction that it is America's purpose to lead in the technological race in space.

It is my purpose today to explore with you the motivations, the costs, the degree of difficulty and the benefits and needs resulting from a national commitment to an accelerated program for an early lunar landing and return.

We all remember Oct. 4, 1957—the day that the Soviet Sputnik I awakened the world to the dawn of the space age. The reaction of many of our elected and appointed officials was confused and fragmentary. We were alarmed at President Eisenhower's casual reaction to Sputnik I—"it doesn't bother me one iota." Sputnik I was called "a bauble" and we were admonished not to compete in a space age basketball game.

However, America's future in space had been assured by the Air Force intercontinental ballistic missile program under the leadership of Dr. John von Neumann, General Schriever, and Dr. Simon Ramo, and by the Army's Redstone program, under the leadership of Dr. von Braun. Many of us who had been associated with the ICBM development program since early 1953 had strong convictions that this first family of space vehicles was the immediate answer to Sputnik I and would add greatly to America's nuclear deterrent strength.

We were therefore exultant when, on Dec. 17, 1957 (just a little over three years from the date of acceleration of the project), America's first operational intercontinental ballistic missile flew to full range and landed in the water of the South Atlantic. Since then, the ballistic missile portion of our space activity has continued with phenomenal success. It now provides our nation with a vastly increased retaliatory power. Our military program also provides over 90% of the support for our civilian space experiments.

Cautious Approach

Our history in other space developments has been characterized and constrained by a cautious, unimaginative approach—symbolized by the lack of development of big boosters. Even though President Eisenhower later clarified his meaning of the word "iota" by recommending a billion-dollar space budget to the Congress, we still continued to lag far behind the Soviets in the development of the propulsion systems needed for the conquest of space.

Our active and articulate budget planners crippled and halted this development until finally in November, 1960, under heavy pressure from the Congress, the President added sufficient funds to make a small beginning in the large chemical booster field, and a minuscule beginning in the nuclear propulsion field.

The fact still remains that we cannot talk, rationalize, or organize our way into space. We have to boost our way into space with a broad-based and imaginative liquid, solid, and nuclear "crash" program in this field. This is the central and immediate technical urgency of the President's program.

Many of our military planners and scientists are opposed, for a variety of substantive and philosophical reasons, to committing the nation to a space race with the USSR. This has resulted not only in a drastic limitation on the scale and scope of our planning for space experiments and space exploration, but also has resulted in a serious limitation on military space developments.

Even after the USSR has repeatedly demonstrated its ability to orbit a 10,000-lb. satellite and land it at a time and place of its choosing, we still have no active satellite defense program beyond the paper planning stage.

I believe the general public reaction to the President's decision has been affirmative. However, the phenomenal success of the NASA sub-orbital flight experiment involving Commander Shepard has tended to lull us into a state of relaxed euphoria concerning America's over-all position in the space race. This could prevent a complete endorsement of the President's proposal by the Congress.

The Gallup Poll taken just before the President's message to Congress states that only one person out of three was clearly in favor of a major lunar program. The question asked in the Gallup Poll was:

"It has been estimated that it will cost the United States roughly $40 billion total, or an approximate average of $225 per person, to send a man to the moon. Would you like to see this amount spent for this purpose?"

The results were: yes, 33%; no, 58%; no opinion, 9%.

These results were published after the President's speech almost as though they were a reaction to it. They were also based upon the false premise that the lunar project would cost $40 billion while the President's message asked for seven to nine billion dollars additional over the next five years. In addition to the Gallup Poll, a number of newspaper commentators have questioned the benefits and wisdom of the project while overestimating the possible cost.

Fortunately, many members of the press understand that the lunar mission is a sensible national space goal since it is a space objective which we will achieve in time in any case and which, by being well planned and placed upon an urgent time schedule, can accelerate progress in vast areas of science and technology having civilian as well as vital military importance.

It is also well recognized by all that achieving the lunar landing after the USSR would seriously damage our prestige throughout the world.

It is important that we understand the general value of lunar exploration so that it will be manifestly clear that we are not just buying a "stunt" for many billions of dollars, but rather are undertaking the first in a series of events which will have a profound effect upon the course of human history. It is entirely possible that in two or three decades, the scientific, economic, technological, and military importance of the moon will cause us to consider it as valuable as certain pieces of real estate on earth over which major wars have been fought or over which disputes are presently pending.

It is not too fanciful to believe that in 1981, we will consider the moon more valuable than the Ruhr Valley, or Korea, or Laos, or Berlin. Certainly, in 1961, to some scientists and all lovers, the moon is already far more important than was the purchase of Louisiana or the purchase of Alaska.

Trevor Gardner is chairman and president of Hycon Manufacturing Co., and he also is a trustee of Aerospace Corp. and a consultant to the Air Force Scientific Advisory Board and the chief of staff. Earlier this year, he served on President Kennedy's Space Task Force and was chairman of the Air Force Space Study Committee, appointed by Gen. Bernard A. Schriever, commander of the Air Force Systems Command.

Gardner was special assistant for research and development to the Air Force secretary (1953-55) and assistant USAF secretary for research and development (1955-56) before resigning from the Eisenhower Administration in protest against its defense policies.

Born in Cardiff, Wales, in 1915, he became an American citizen in 1937 and received a bachelor of science degree in engineering and a master's degree in business administration from the University of Southern California in 1939.

Gardner was head of development engineering for rocket and atomic bomb projects in the Office of Science Research and Development at the California Institute of Technology during World War II.

After the war, he was executive vice president of General Tire and Rubber Co. of California before forming Hycon in 1948. He has taught mathematics and industrial management at USC and Cal Tech.

The lunar project is a natural focus for vast space activity. In order to achieve a manned lunar landing and return, certain basic space capabilities must be developed. These are the same capabilities which are required for a large scale military, scientific and technological utilization of space. They are principally:

- **Ability to orbit,** maneuver, rendezvous, de-orbit, re-enter and land.
- **The building of space** stations and the support of manned occupancy.
- **Sustained manned** space flight.
- **Guidance, navigation** and communications systems necessary for large scale space operations.
- **Development of standardized** launching techniques and launch vehicles. This will greatly decrease cost of space operations.

All of these capabilities are military necessities and vital to our national security.

The lunar project will automatically result in the early attainment of certain achievements, some of which may be "firsts,"–most of which will have high prestige value. They are:

- **Sustained manned orbital** flight, and controlled re-entry.
- **Demonstration of rendezvous** with physical contact.
- **Use of men in space suits** working outside of orbiting space vehicles.
- **Detailed high resolution** photography of lunar surface.
- **Unmanned lunar** soft landing.
- **Unmanned lunar** soft landing with lunar surface samples returned to earth.
- **Manned** circumlunar flight.

The capabilities needed for the lunar mission also provide the basis for true scientific space exploration. The accelerated lunar project will increase the rate at which scientific information is obtained from a study of the moon's environment surface, and subsurface. The surface environment of the moon, while hostile, is quite unique and makes the surface of the moon valuable as a base for scientific observations other than the study of the moon itself. A lunar scientific laboratory will be an invaluable resource for increasing man's knowledge of the universe.

It is difficult to assess the technological or economic value of the moon. In general, certain properties of the moon appear likely to be of significant importance in the expansion of our technology:

- **Low surface gravity**—of particular importance for using the moon as a base for space operations.
- **Near vacuum conditions**—important for space operations and vacuum technology.

Technological possibilities that may exist are:

- **The placement of masses** of rocket propellant, produced on the moon, in

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various orbits crossing cislunar space as a means of drastically reducing the cost of space operations.

- **Construction of very large,** high-current particle accelerators on the moon's surface, for large-scale production of isotopes, including plutonium and U-233.
- **Large-scale production** of new materials requiring near vacuum pressures for production.
- **Construction of space vehicles** for very large-scale exploration of deep space.

A variety of general benefits will result from space operations and the accelerated technology resulting therefrom. Service satellites will render new services to the entire world. These services are: improved meteorological information; navigation, public communication; international television; arms control communications; and scientific experiments such as instrumented deep space probes or a manned satellite observatory.

Already in the process of exploring outer space, many practical by-products of scientific and technological research have emerged. More are on the way. These range from infrared food blanching to woven stainless steel cloth and advanced transistors.

The new power sources being developed for space use already seem to have many applications on earth. In the not too distant future, our ability to use and store solar energy and to build small nuclear power supplies will find applications throughout the world. Additional examples are improved protective clothing; improved plastic fabrics; more efficient and longer lived lubricants; stronger and more versatile adhesives.

The earthly by-products of the lunar adventure will clearly be numerous. Their value to mankind, while now only dimly envisioned, may alone justify the cost.

Lunar Program Costs

Cost estimates for this project having a reasonable degree of reliability are impossible at this time. A variety of estimates exists. Cost is affected by the choice of propulsion system, option to stage from satellites, the number of passengers to be carried in the first expedition, and the number of miscalculations or mistakes which we make. Estimates made by responsible individuals and groups have ranged from $3 billion to approximately $10 billion. Other responsibile individuals and groups, who have studied the subject only in a cursory manner, have tended to double or quadruple these estimates.

It seems more probable that the lunar landing and return mission can be accomplished for approximately $10 billion, rather than $40 billion. It should be noted that we are already proceeding with a military and civilian space program which spends approximately $2 billion per year. It may well be that these funds will be spent more efficiently as a result of the focus on the lunar mission.

The opportunities, challenges and demands of the space era appear to require not $2 billion a year but a $5 billion a year space program by about Fiscal 1964.

These sums seem large, but for a nation whose gross national product is $500-plus billion and going up, it is approximately 1% of the G. N. P. Much of this cash will be regenerative and not just "wasted". This covers not only the down payment but also the progress payments required to reach into this vast new frontier at a rate limited only by the imagination and genius of our scientists, technologists and managers.

Relative Values

Perhaps a more relevant observation is that a nation which spends some $40 billion a year for amusements, and some $11 billion a year on advertising of its amusements and products, clearly has the resources to support a major space program. By no stretch of the imagination can it be argued that a major space program is a more trivial enterprise or one less certain to produce lasting satisfactions than either of these "sinks" for our excess energy and wealth.

We should clearly recognize, however, that our investment in space activities has to be "additive" to our investment in other areas of national security, such as Polaris missiles, intercontinental ballistic missiles, limited war forces, foreign aid, strategic nuclear air power, anti-ICBM, and space defense systems. This is the unhappy reality of our time.

There is little reason for being appalled by the sheer magnitude of the effort required to develop a major space exploration capability. Many examples exist in history of massive endeavors which were very much more prodigal and consumed a far greater fraction of available energy and resources than will be required in the proposed lunar program. Some of these are the construction of the pyramids of Egypt, the great wall of China, the cathedrals and monastic buildings of the Middle Ages, and even prehistoric examples such as the great constructs in Brittany.

Compared to such historic endeavors, manned lunar bases, manned artificial satellites and exploration of the moon and planets will probably require less total human energy but will yield immensely greater benefits and satisfactions to mankind.

Compared with the major explorations of history, it is clear that the exploration of the moon, and later the planets, will dwarf all others—the great military explorations of Alexander the Great, Hannibal, Caesar and Ghenghis Khan, as well as the civilian explorations of Columbus, Cabot, Darwin and Amundsen, will be overshadowed in historic importance.

None of the recent scientific and technological enterprises—atomic bomb, hydrogen bomb, nuclear-powered submarine, Polaris submarine, liquid ICBM and Minuteman—compare in magnitude and complexity with the proposed lunar program. It is for this reason that the President has specified that we must marshal our scientific and technological resources and manage them with great skill in order to achieve success on a schedule which the ingenuity of the scientists of the USSR has already established for us.

In this connection, we should recall the inadequacy of the planning, funding and execution of our first space satellite, Project Vanguard. It is painful now to recall the prestige cost of the repeated failures of this, our first venture into space. We dare not permit a repeat performance in our lunar adventure.

The paramount need of the accelerated lunar program was the President's decision to proceed. This decision, when approved by the Congress, will quickly result in a chain reaction of urgencies which must be satisfied. Underlying all of these, there is the necessity, not only to succeed in an extremely difficult task, but to succeed ahead of the USSR.

Since our society is an open one, and since the Soviets do not seem likely to join with us in an international lunar program, they will have two principal advantages should they select an early lunar landing as their objective. These are:

- **Their important lead** in large boosters, and . . .
- **Their Iron Curtain** secrecy.

Concept of Concurrency

The concept of concurrency so well developed in the Atlas, Titan and Minuteman will have to be exploited to the fullest. It will be necessary to embark upon parallel approaches to many problems. Management will have to be alert that duplication is purposeful and not wasteful, but duplication to "buy time" will be required.

Because of the international interest in this massive national adventure, the support of the American people and of congressional committees is of the utmost importance. In the past, congressional committees have greatly assisted executive management in the execution of difficult tasks. This pattern must be repeated in the case of the lunar program. A special lunar exploration joint committee of the Congress seems warranted.

The degree of difficulty of the problem forces immediate concern with the vital details of the precise management techniques, management organization and quality of scientific personnel which the government will select for execution of the program. This management problem cannot be deferred or submerged by our complicated and separate space and missile organizations. The President and the program deserve the best. The country must demand it.

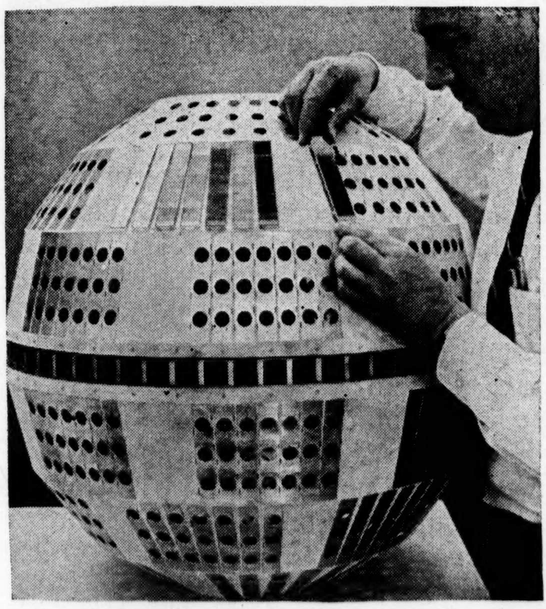
Only the most streamlined management channels, centralization of authority (technical, operational and procurement), absence of "kibitzing" by ad hoc groups, and the application of our proven management resources developed in the nuclear and missile programs can insure success.

While undoubtedly the program will develop a new group of scientists and managers of unique competence, my general confidence level on the project would be increased if I knew the management talents of professionals with a record of success on technically difficult programs will be fully utilized. For example, the program is vital enough to fully utilize the training, experience, and genius of both such men as General Bernard A. Schriever and Admiral "Red" Raborn. Scientifically, the problem is complex enough to warrant the best talents of the late, great Dr. John von Neumann, Dr. Albert Einstein, and Dr. Enrico Fermi. We must seek out their living counterparts for this program. We must architect the management structure and its scientific, military and industrial support with the most sensitive artistry. Otherwise, we may find ourselves in the position that we would have been in had we tried to invent the atomic bomb with just the bureaucratic entity of the Atomic Energy Commission, devoid of the wisdom, intellectual leadership and dedication of Oppenheimer, Einstein, Fermi, Kistiakowsky, Bethe, Teller, Szillard, Lauritsen, von Neumann and Ulam.

The Soviet space program is a direct challenge to the security and prestige of this nation:

- **In the organization** of the nation's resources to seize opportunity in new fields of human endeavor created by the scientific revolution.
- **In the selection** and achievement of national objectives.
- **In the race** for leadership in ICBMs and space technology.
- **In the international** competition for technological stature.

Using a vigorous program of space activities as a backdrop, the USSR seeks to demonstrate that their political and economic system is superior to ours; that their military capability is superior to ours; and that the power and vitality of the communist state is superior to ours. President Kennedy's space program, as proposed to Congress on May 25, 1961, is our nation's answer to the Soviet challenge.



AT&T's Comsat

Commercial communications satellite under development by American Telephone and Telegraph Co. will use synthetic sapphire strips to cover solar cells for protection against Van Allen and other space radiation.

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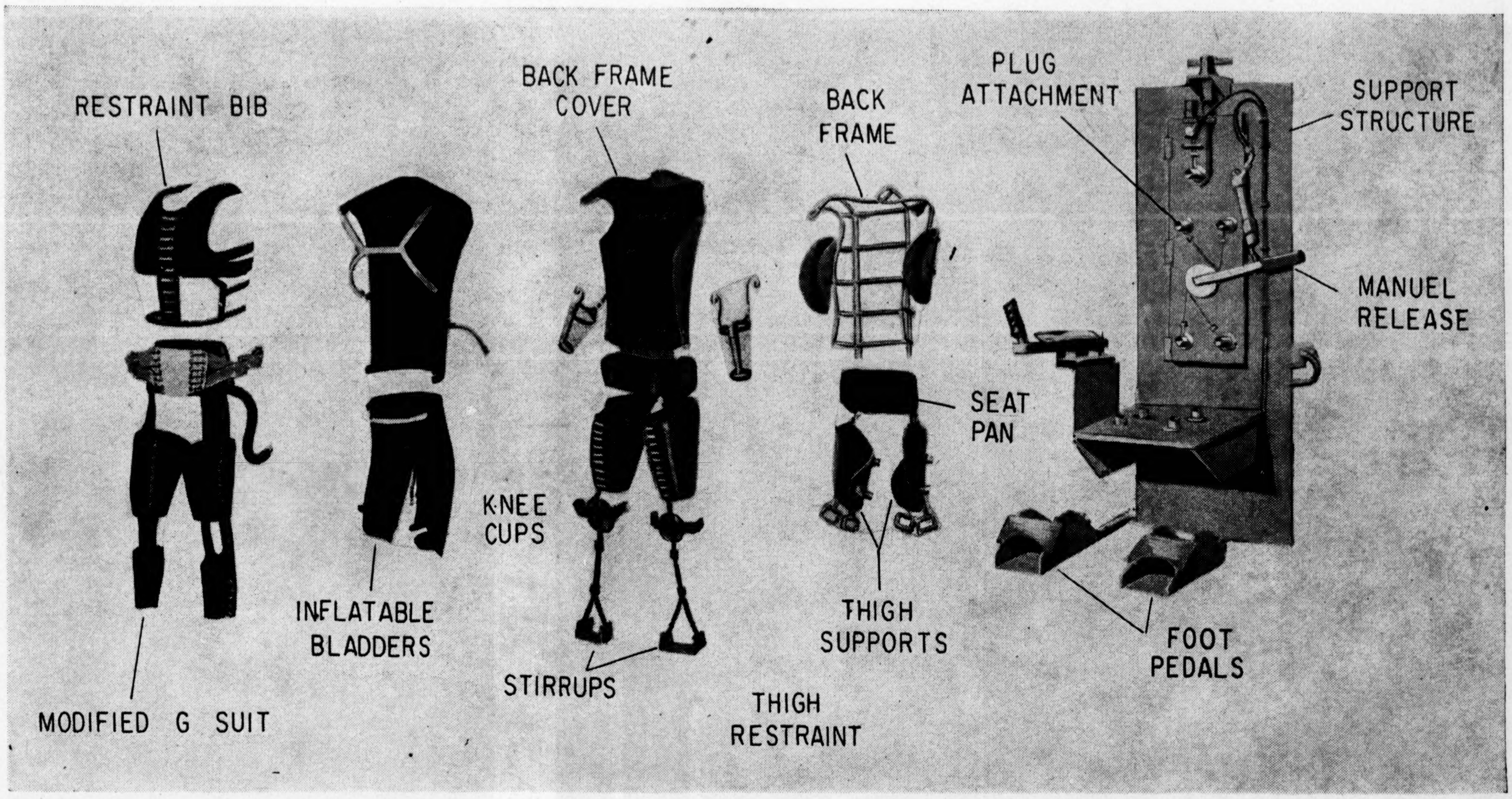

SKETCH shows composite parts of the restraint suit. Note mounting plate with female plugs on basic seat. In present system, lever which retracts locking pins only can be operated by ground personnel. In an operational system, Ames engineers said, the lever could be repositioned on an arm rest for direct pilot operation and, after retracting each locking bar, the pilot could step out.

NASA Develops High-Mobility Space Suit

By George Alexander

Support and restraint suit for space pilots, light and mobile enough so that it can be worn as personal equipment and adjustable to any individual's form, has been developed and centrifuge-tested by the National Aeronautics and Space Administration's Ames Research Center, Calif.

Three-size (small, medium and large) experimental system, weighing a maximum of 36 lb. in any one size and configuration, may eventually find application on multi-manned space vehicles characterized by long-duration flights and high g loads at launch and re-entry. It was described to the recent Aerospace Medical Assn. meeting in Chicago by three Ames engineers, Hubert C. Vykukal, Richard P. Gallant and Glen W. Stinnett.

The system's design requirements called for a high degree of pilot mobility and arm/leg freedom, once either in orbit or en route on a deep space probe; adaptability to a variety of pilot sizes and shapes and adequate support against high g forces applied posteriorly (back toward chest), anteriorly (chest to back) or vertically along the spinal axis. In test pilot jargon, these g forces are respectively termed eyeballs-in (EBI), eyeballs-out (EBO), and eyeballs-down (EBD). Mercury pilots will normally only experience EBI forces at launch and re-entry, but a Dyna-Soar or Apollo crew, for example, would be exposed to both EBO and EBD loads as they re-enter the earth's atmosphere at very high velocities and execute a series of banks preparatory to landing, always in a face-forward position.

The mobile couch-and-restraint system, tested by human subjects under 14g EBI for 2 min., 10g EBO for 1.5 min. and 7g EBD for 1.25 min. on the Navy's Johnsville, Pa., centrifuge, consists of four major assemblies: torso, pelvic and legs, extremities and head.

Portable Couch

Most unusual feature of the system is the portable and universal-size couch worn by the pilot; two inflatable bladders, one covering the back and the other the buttocks and thighs, conform to the pilot's shape when seated. Of ribbed, rubberized cloth construction, the bladders are inflated to a pressure deemed comfortable by the pilot and provide substantially the same type of support as the costly, individually molded couches of Mercury pilots. Although the bladders have been inflated with air for the centrifuge tests, the Ames engineers believe that the undesirable rebound characteristics of air may demand the substitution of an oil or a plastic foam in the operational systems.

Pilot, after donning the inflated bladders, puts on a welded-aluminum grid frame which attaches to a mounting plate on the basic seat structure. Frame, fitted with a heavy-gage nylon cover, is shaped in the general contour of the human back and extends slightly over the pilot's shoulders and up around the sides of his chest. Glass fiber shells, approximately the shape of the upper arm, are fixed to the frame sides for EBI support.

Mounting plate is movable, up or down, to adjust for varying spinal lengths of pilots.

For anterior EBO support, the pilot wears a vest-like bib with adjustable center lacing. Upper half of the bib, running from the collarbone to the middle of the chest, consists of heavy-gage nylon straps and carries the main g loads on the chest. Lower half, extending to the midriff, is of two-way stretch nylon material and holds in the abdominal area. Heavy nylon straps, sewn integrally into the bib, lead back to the aluminum frame and are secured there by three bar fasteners.

For buttock and thigh support, a nylon seat pan is attached to the aluminum frame and incorporates a belt and buckle for tightening the unit to the buttocks. Thighs are supported by two semi-cylindrical shells, similar to the upper-arm pieces, suspended from the pan. Restraint of the thighs is effected by two nylon covers, attached to the shells, which are closed by zippers and laces.

Two approaches are under consideration for pelvic restraint and lower extremity support: the first combines two-way stretch nylon pants, much like leo-

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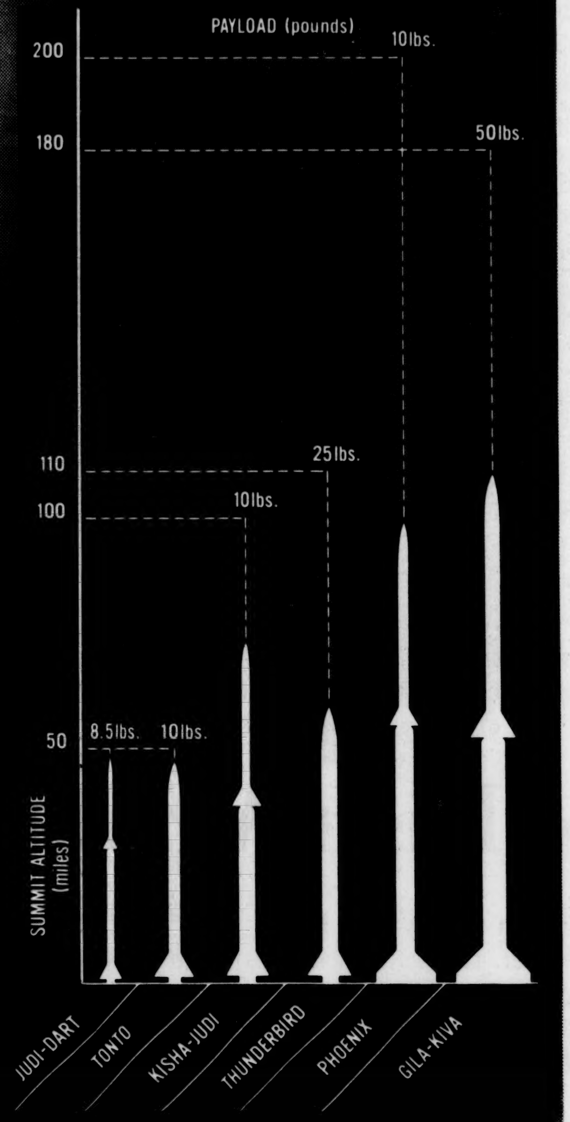

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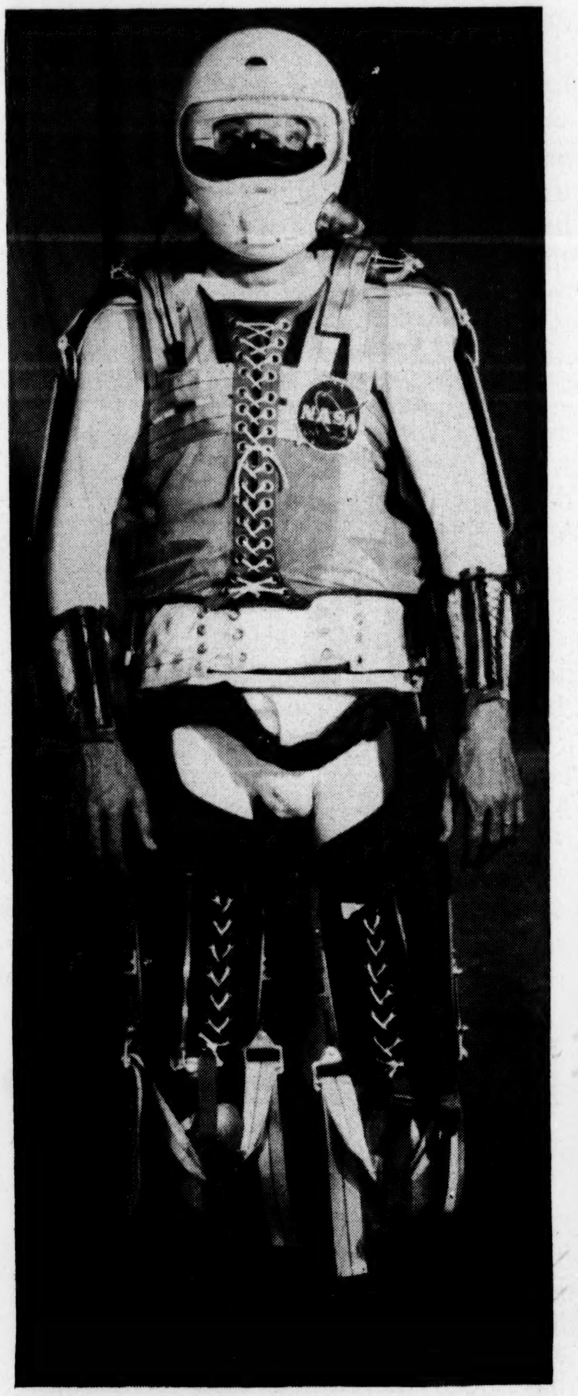
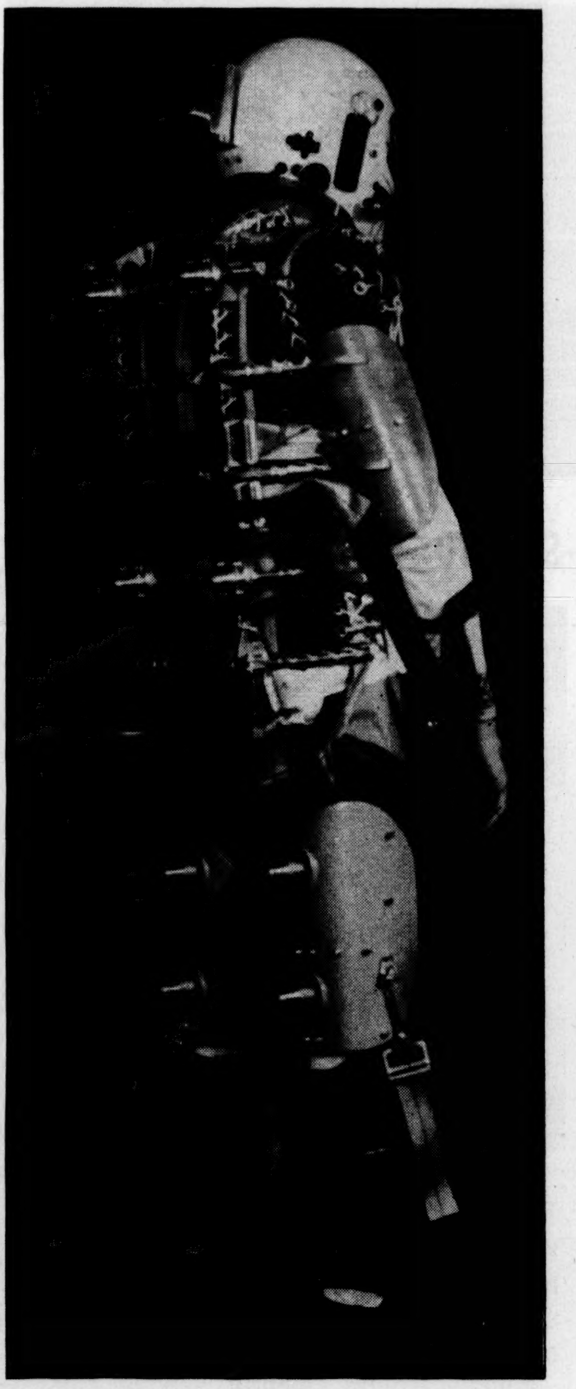


FRONT VIEW of NASA's Ames Research Center's flexible space suit shows exhalation baffle over pilot's nose, chest and abdomen restraint, lap belt, pendulum-connected cuffs and modified chap-type g suit. The suit eventually may find application on multi-manned, long-duration space flights.

tards, with a girdle, the latter including stays, brief legs and a lap belt. Second method is a chap-type anti-g suit, modified by connecting the pressure lines directly to the leg inlets. Two pressure sensing valves are oriented perpendicular to each other so that regulation would be in both EBO and EBD directions.

Knees are held by foam rubber-lined metal cups, contoured to the bent knee. Straps tie the cups to the thigh shells and to the boots. Forearms are restrained by nylon-mesh cuffs which are connected to a viscous-damped pendulum. Pendulum counterbalances the mass of the pilot's forearm and hand during an EBO situation and permits working of the hand control stick. Feet are inserted in stirrups and secured by fold-over plates.

Pilot's helmet is a two-piece, laminated glass fiber assembly. Front half



REAR VIEW of NASA's experimental suit shows aluminum grid frame, glass fiber upper arm and thigh shells and back half of two-piece helmet. Inflatable bladders are worn between frame and pilot's back. Pins on back of frame, thigh shells and helmet fit into plugs on basic seat structure.

consists of the external shell, housing a standard window, a polyurethane foam facial support insert and a rubber seal diaphragm. The foam insert, the only item in the system made to fit a specific individual, spreads the load-bearing area over the pilot's cheek bones, jaw and forehead. Impression cast, it crushes at 50 psi.

The rubber diaphragm, placed between the foam insert and the face, functions as a seal for the ventilation system. Oxygen is brought in through the top of the helmet and down across the window for anti-fogging. A rubber baffle, fitted over the nose, prevents exhalation on the front pane.

Back half of the helmet is cushioned and contains a movable plate, controlled by a small knob on the right side of the hard hat. Moving the plate forward forces the pilot's face snugly into the seal and insert and also allows for varying head depths (measured from nostrils to skull base) among pilots.

Rapid connection and disconnection of the couch-and-restraint system to the basic structure is achieved by the use of shear pins—one on the helmet, four on the aluminum back frame and two on each thigh shell. Each tapered, spring-loaded pin mates with a plug on the basic structure; once inserted, the springs are released and the locking bars slide through the pins. Release is simple: each locking bar is connected by a wire to a wheel mounted in the center of the structure's back. The wheel, in turn, is activated by pulling down on a lever.

Soviet Union Awards Medals for Space

Moscow—Soviet Union has awarded medals to more than 7,000 scientists, designers, engineers and technicians for their roles in space achievements which culminated in Maj. Yuri Gagarin's orbital flight.

In a continued reflection of the deep secrecy of the program, however, only top recipients were identified. Among them was Premier Nikita Khrushchev, who received the Order of Lenin and third Hammer and Sickle Gold Medal of Hero of Socialist Labor for his "outstanding services in guiding the creation and development of the rocket industry."

In a talk here with U. S. Communist chief William Z. Foster, Gagarin praised the courage of Astronaut Alan B. Shepard, Jr., saying Cdr. Shepard did "the most that could be done considering the level of American science and technology."

Discussing his flight, Maj. Gagarin said:

"Crossing the Western Hemisphere, thinking about America, I couldn't help thinking about the boys who were getting ready to soar into space in our wake. For some reason I thought Alan Shepard will be the man. Perhaps because I like him more than the rest—he didn't fight in Korea as did his two colleagues [Marine Lt. Col. John H. Glenn and USAF Capt. Virgil I. Grissom]."

Others identified as award recipients in ceremonies in Moscow were Frol Kozlov, secretary of the Party Central Committee; Mstislav V. Keldysh, president of the Soviet Academy of Sciences; Dmitry Ustinov, deputy chairman of the Council of Ministers; Konstantin Rudnev, recently named chairman of the State Committee for Coordination of Scientific Research; Valery Kalmykov, chairman of the State Committee for Radio and Electronics, and Leonid Brezhnev, chairman of the Presidium of the Supreme Soviet.

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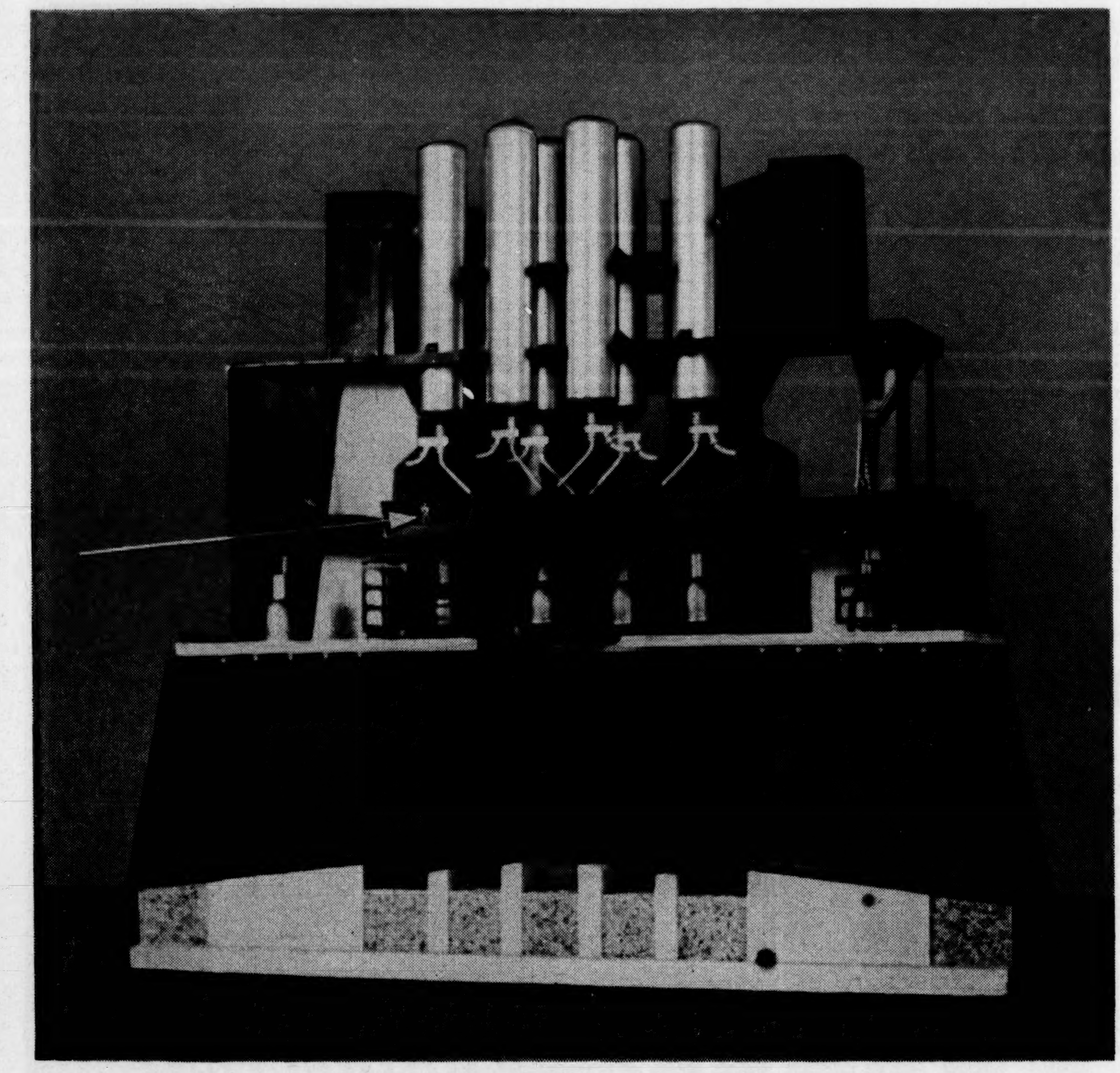
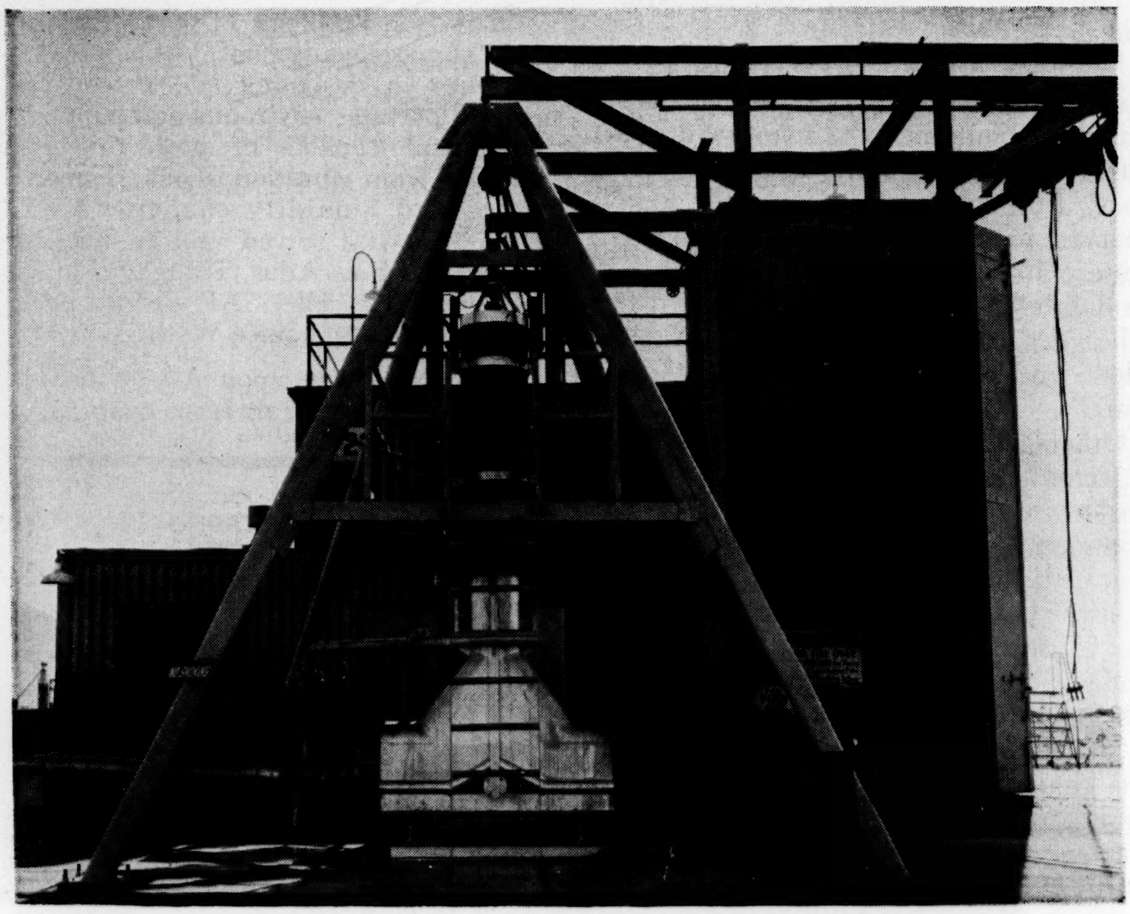
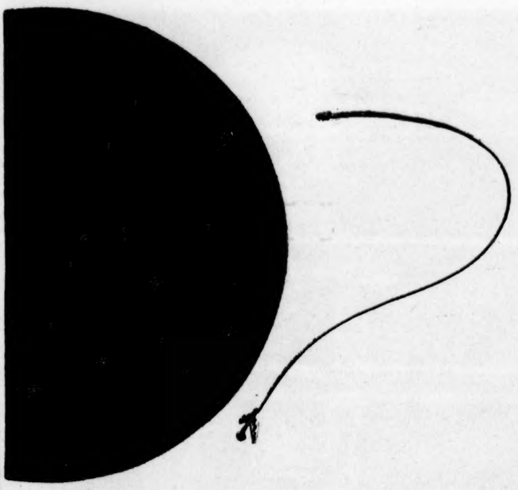


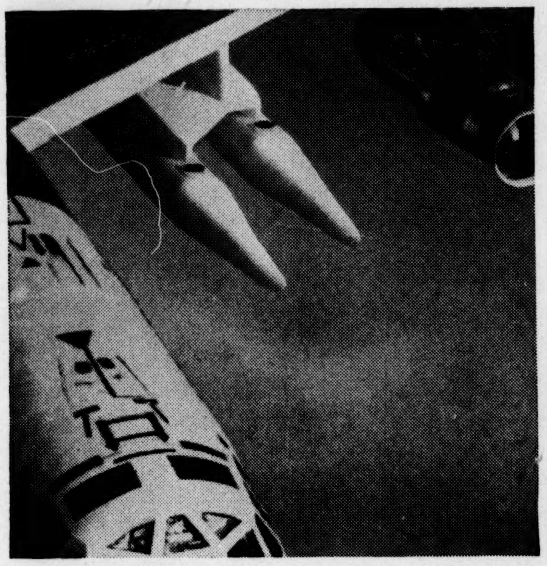
Large Booster Test Stand Proposed

Cutaway model of a large test stand proposed by Cal-Val Research and Development Corp. (above), shows grid of water cooler-silencer unit below motors. Test stands have been designed in modular sizes ranging from 6 to 24 million lb. thrust. Layout can be adapted to fly-out silo concepts and to offshore sites. This stand would be approximately 225-ft. high. Man (arrow) gives indication of size. Cooler-silencer test run by Navy at Pt. Mugu (below) used 4,000-lb. JATO unit as exhaust producer. Cal-Val silencer is the inverted Y-shape below the nozzle. Cooling water at 1.3 times propellant flow rate reduced noise level from 135 db. to 104 db. 4 ft. below the nozzle and also caused exhaust temperatures to be lowered from 3,900F to 158F at the same point below the nozzle.





SKYBOLT



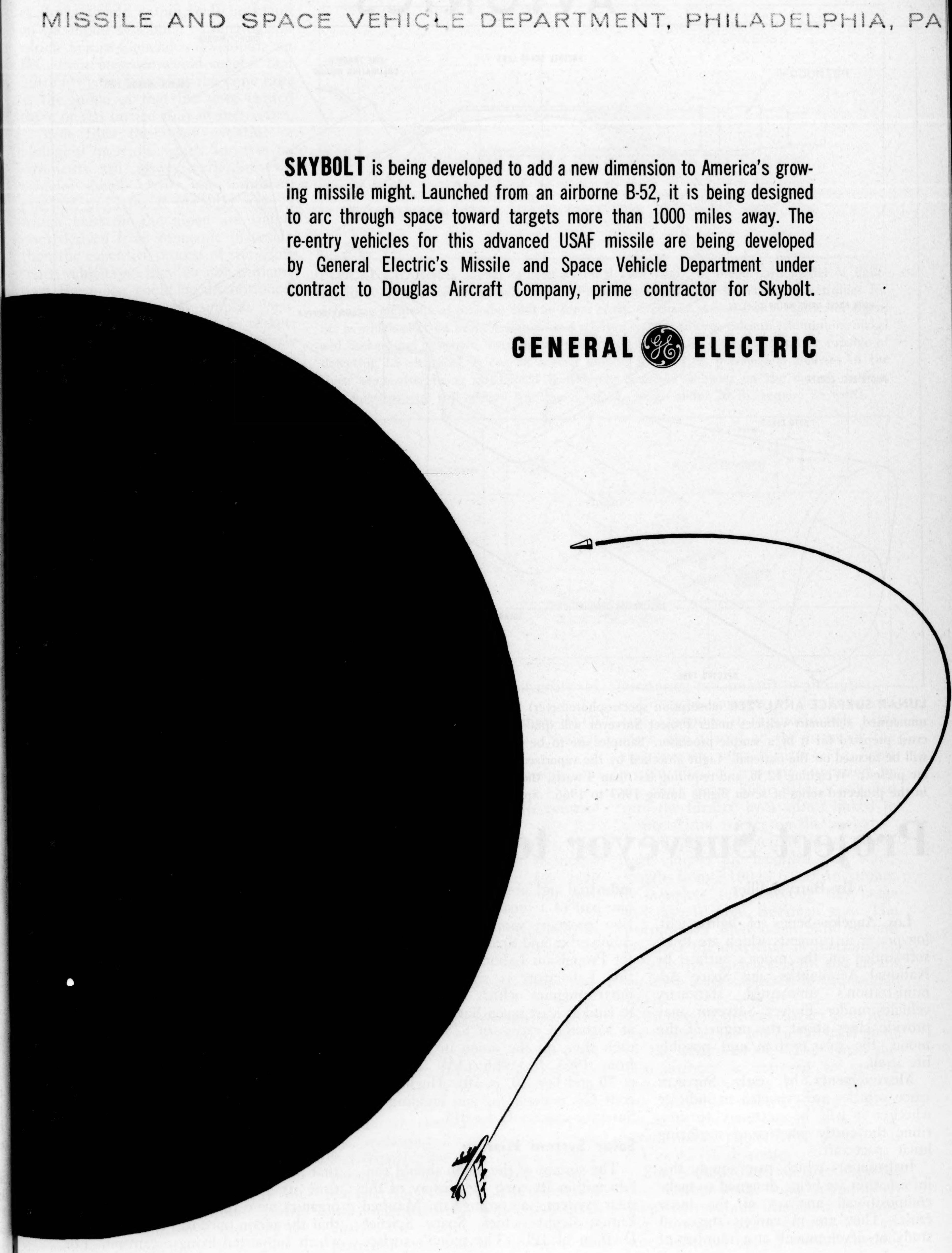
This new USAF weapon now under development will combine the range and mobility of the jet bomber with the speed and the difficult-to-detect capabilities of the ballistic missile. Yet Skybolt's warhead-carrying re-entry vehicle must operate with the same reliability and accuracy of ground-launched re-entry vehicles.

Environmental conditions—The re-entry vehicle must withstand hour after hour of vibration and noise fatigue aboard its bomber "launching pad"—the USAF B-52 and the RAF Vulcan bomber. Its heat protection system must endure repeated thermal cycling from ground take-off temperature to —65° F at cruising altitudes. If launched, it could be exposed to re-entry temperatures of 7500° F.

Extended Life—Skybolt's re-entry vehicle must have a useful life of several years, through repeated storage, thermal cycling, and return to storage—all with a minimum amount of maintenance.

The Skybolt missile system is being developed from known and proven engineering principles, resulting in rapid program advancement at great saving to the American taxpayer. The Missile and Space Vehicle Department of General Electric's Defense Electronics Division is developing Skybolt's re-entry vehicle. 160-05

GENERAL ELECTRIC



MISSILE AND SPACE VEHICLE DEPARTMENT, PHILADELPHIA, PA

SKYBOLT is being developed to add a new dimension to America's growing missile might. Launched from an airborne B-52, it is being designed to arc through space toward targets more than 1000 miles away. The re-entry vehicles for this advanced USAF missile are being developed by General Electric's Missile and Space Vehicle Department under contract to Douglas Aircraft Company, prime contractor for Skybolt.

GENERAL ELECTRIC

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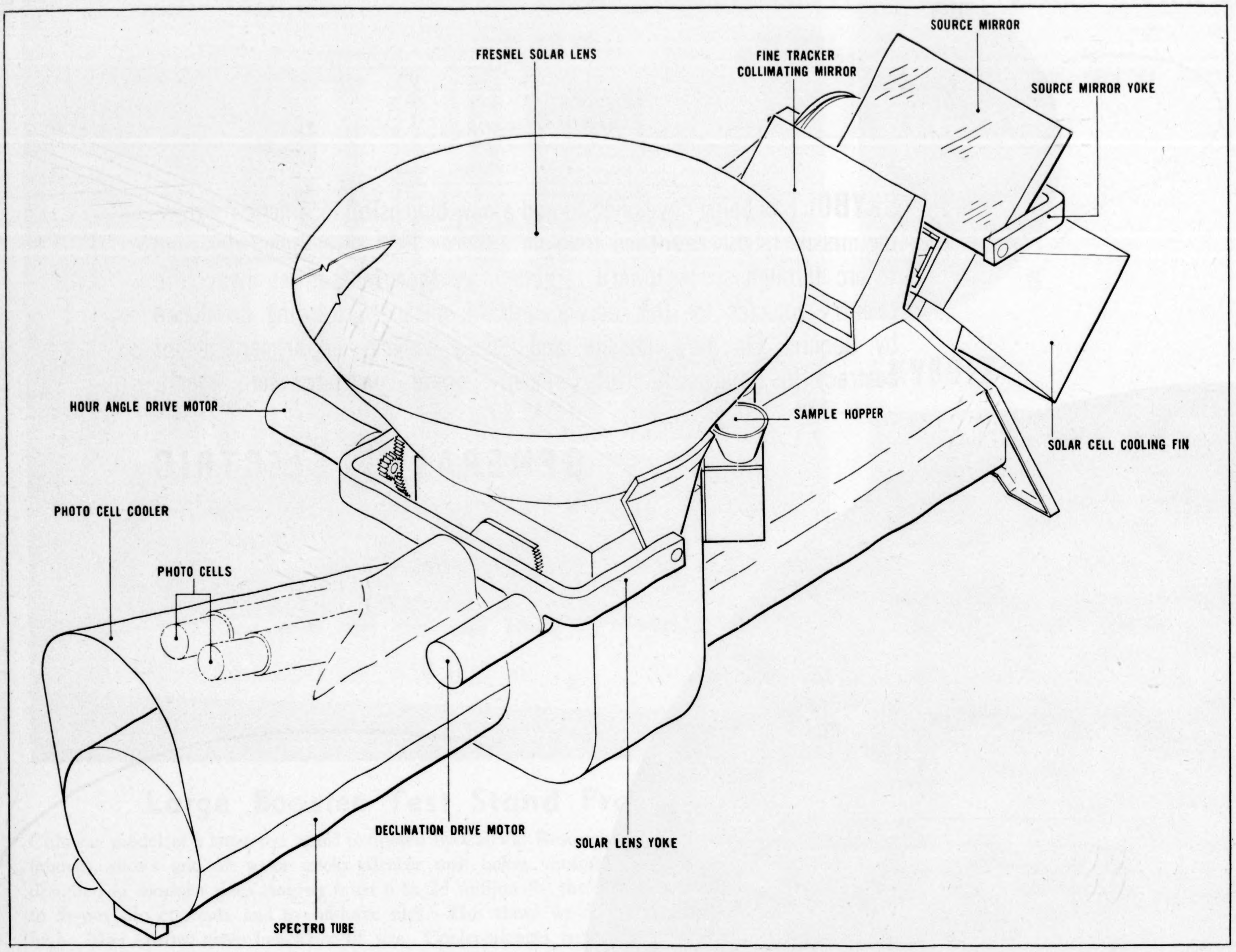


LUNAR SURFACE ANALYZER (absorption spectrophotometer) being developed by Beckman Instruments for Jet Propulsion Laboratory's unmanned, stationary vehicles under Project Surveyor will qualitatively and quantitatively analyze five-gram samples of pulverized lunar crust prepared for it by a sample processor. Samples are to be vaporized inside a solar furnace (Fresnel lens) and reference light beam will be focused on the material. Light absorbed by the vaporized sample is recorded as a function of wavelength indicating what elements are present. Weighing 12 lb. and requiring less than 4 watts, the instrument is expected to be flown in one of the later Surveyor vehicles in the projected series of seven flights during 1963 to 1966. Spectrophotometer will measure 22 in. x 8 in. x 9 in.

Project Surveyor to Seek Solar Origins

By Barry Miller

Los Angeles—Series of lightweight, low-power instruments which are to be soft-landed on the moon's surface by National Aeronautics and Space Administration's unmanned, stationary vehicles under Project Surveyor may provide clues about the origin of the moon, the solar system and possibly life itself.

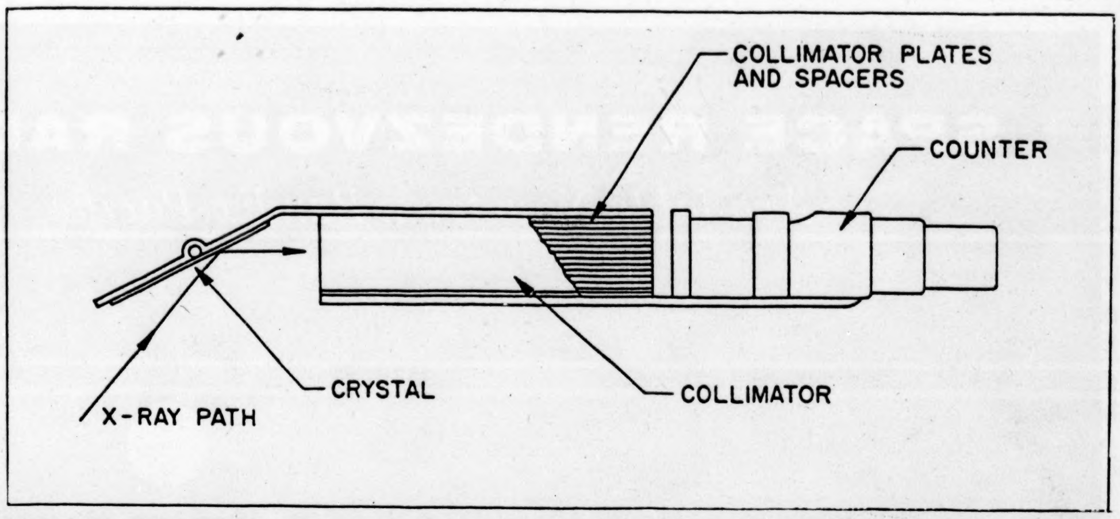
Measurements by early Surveyor space vehicles are expected to indicate whether it will be necessary to continue the costly practice of sterilizing lunar spacecraft.

Instruments which may supply this information are being designed to make compositional analyses of the lunar crust. They are in various stages of study or development at a number of industrial and university laboratories as one part of a broad lunar instrumentation program sponsored by National Aeronautics and Space Administration's Jet Propulsion Laboratory. Jet Propulsion Laboratory is managing NASA's lunar program which currently plans to land at least seven Surveyor vehicles, at a cost in excess of $25 million for each shot, on the moon in the period from 1963 to 1966 (AW Feb. 20, p. 70 and Jan. 30, p. 50). Hughes Aircraft Co. is designing and building the Surveyor spacecraft for JPL.

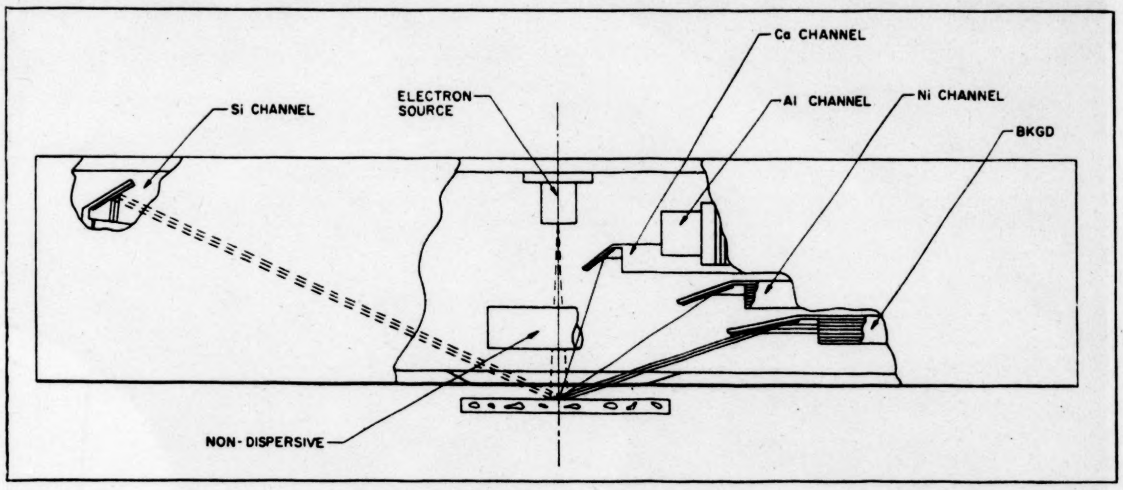
Solar System History

The surface of the moon should contain within its crust the history of the solar system, according to Manfred Eimer, deputy chief, Space Science Division of JPL. The moon's surface has not been subjected to the erosive effects of winds, rains and floods as has our earth. In the absence of a protective atmosphere, meteors have been able to impact on its surfaces which have also been exposed to different forms of corpuscular and electromagnetic radiation. These surfaces are expected to reveal a wealth of data about the solar system.

The presence and nature of organic materials—whose possible existence on the moon is expected to be determined by JPL instrumentation—should help to confirm or rebut several theories about organics. These include the possibility that nutrients were formed at the same time as the mass of the sun, that organics were formed spontaneously or that the moon once had an atmosphere which supported living organisms. For



TYPICAL CHANNEL, shown in cross-sectional view (top), of breadboard model of lightweight X-ray spectrometer built for Jet Propulsion Laboratory by Philips Electronics for detecting elements of periodic table in lunar crust. Cutaway sketch (below) indicates chamber in which electron beam is formed and relation to it of silicon, calcium, aluminum, nickel and background channels. Instrument, which will have 15 fixed channels and be capable of detecting 13 elements, is one of several devices for making petrological analyses of the lunar crust after being soft-landed in different Surveyor vehicles on the moon's surface. This spectrometer will occupy less than 1 cu. ft., weigh about 20 lb., require 25 watts.



example, should amino acids be found on the moon by a lunar chromatograph which Aerojet-General is developing for JPL, their presence would suggest that nutrients were formed at the same time as the moon or that life once existed there or was carried to it by meteorites.

Aside from the many scientific or biological questions which Surveyor instruments will answer, early Surveyor vehicles should clarify one important practical problem. If the only organics which exist on the moon are simple ones derived from inorganic materials, then the expensive process of sterilizing space vehicles so they do not contaminate the moon could be discontinued. This would considerably simplify logistic support of a moon base as rockets prepared for return to earth similarly need not be sterilized. The decontamination process is a complex one governing design and construction of space equipment.

Some of the instruments and techniques under serious study for lunar analysis were described in several reports presented here recently by Eimer and others at the First National Institute of Aerospace Sciences/American Rocket Society joint meeting.

As part of a complete petrological analysis, JPL and its many subcontractors are in the process of evaluating 10 methods of analyzing what elements as presently known on earth exist on the moon and in what abundance. Exactly which analytical technique will be employed on each Surveyor vehicle and which may be held over for the follow-on unmanned, mobile vehicles of the Prospector series has not yet been decided. Different techniques probably will be employed in successive Surveyor launches to verify findings of preceding vehicles; possibly more than one technique may be used in a single shot.

Petrological Analysis

Petrological analysis constitutes only one portion of a group of measurements to be made by stationary lunar vehicles. Texture, physical properties, body structure and fields, particles, possible atmosphere and ionosphere are also scheduled to be measured.

The 10 methods of determining what elements exist on the moon, laboratories where they are under study and approximate status are:

- **Energetic neutron** inelastic scattering—University of California, Berkeley (breadboard).
- **Mass spectrometry**—Bendix Research Laboratories (study, approaching breadboard).
- **Spectrophotometry**—Beckman Instruments (breadboard).
- **X-ray spectrometry** and X-ray diffractometry—Philips Electronics Instruments (breadboard, more advanced development indicated).
- **Rutherford scattering**—University of Chicago (breadboard).
- **Energetic neutron activation**—Well Surveys, Inc., and Kaman Nuclear (studies completed).
- **Thermal neutron activation**—No contract let.
- **Wet chemical analysis**—No contract let.
- **Alpha activation**—Well Surveys, Inc., has completed study of the technique which has been discarded for lunar analysis because of small yields, poor efficiency.
- **Deuteron activation**—Technique, studied by Stanford Research Institute, has been dropped by JPL.

Instruments embodying these techniques include:

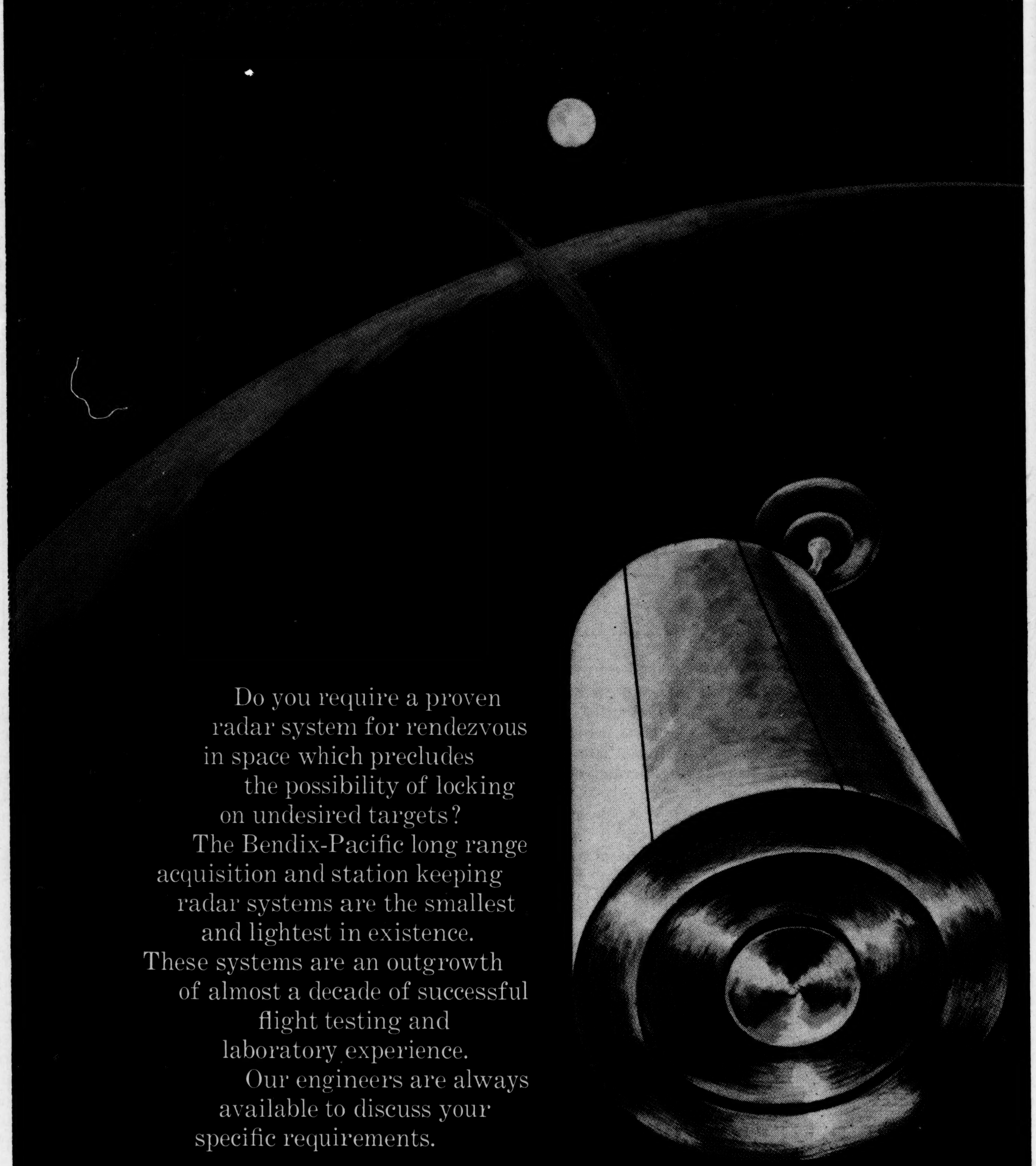
- **Absorption Spectrophotometer** (lunar surface analyzer)—Breadboard model of an unusual absorption spectrophotometer is being constructed by Beckman Instruments, Inc., Fullerton, Calif., under a $55,000 contract from JPL. This instrument, planned as a 12 lb. package, measuring 22 in. x 8 in. x 9 in. and requiring no more than 4 watts of power, probably will be used in one of the later Surveyor shots. The instrument will quantitatively and qualitatively analyze the lunar surface by absorbing particular wavelengths of light and measuring the amount of absorption.

Five-gram samples of the lunar surface, ground to approximately 100 mesh and placed at the focus of the instrument's solar furnace – a lightweight Fresnel lens—are vaporized by the sun's heat. Solar light is reflected into the furnace by a mirror linked to a special sun tracker on the analyzer.

Absorption characteristics of vaporized samples are recorded over wavelengths from 2,100 to 6,000 Angstroms. A complete scan covering this range will take 10 min., Beckman says. The instrument's dual beam ratio system measures the difference in transmission between the reference beam and an absorption beam subjected to the sample vapor.

Purpose of the sun tracker is to hold the image of the sun on the focal point of the solar furnace. The lunar surface analyzer is designed to operate only when the sun is less than 30 deg. from the moon's vertical. Resolution of the instrument is 0.2 Angstrom fixed; photometric accuracy is 0.1 to 0.25% dynamic.

Sun tracker's function is to align the solar furnace image on an appropriately prepared spot and illuminate the grating through separate beams. This ensures identical optical transmission for



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accurate beam comparison. Samples of lunar matter, pulverized by the vehicle's lunar drill, are fed into the analyzer through a hopper and feed system onto a rotating plate. Temperature inside the furnace reaches 4,000G.

- **Mass spectrometer**—Evaluation of mass spectrometer techniques is being conducted for JPL by Bendix Research Laboratories, Detroit. The actual design of a spectrometer for lunar surface analysis is not yet firm, but Bendix indicates it has made such compact instruments—one of which weighs 17 lb., occupies 400 cu. in. and draws 15 watts. The design of Surveyor's mass spectrometer would not necessarily be along the same lines. The mass spectrometer determines the wavelengths of different radiations characteristic of elements in the periodic table.
- **X-ray spectrometer**—An X-ray spectrometer sufficiently sensitive to identify 13 elements yet requiring only 25 watts compared with the 2½ kilowatts needed by a laboratory instrument was described at the IAS/ARS meeting by Dr. David C. Miller in a report prepared by him and Charles F. Hendee, both with Philips Electronic Instruments, Mount Vernon, N. Y.

This spectrometer, developed with the support of JPL, will be able to detect the presence of aluminum, silicon, magnesium, sodium, potassium, copper, sulphur, vanadium, titanium, manganese, chromium, iron and nickel by exciting lunar samples with high-energy electrons, then detecting emitted X-ray radiations. Since the X-ray spectra of these elements are known, presence of the element and amount of it can be determined from the widths and heights of peaks in recorded spectrographic charts.

The X-ray spectrometer tends to be more versatile but less sensitive than the Beckman spectrophotometer which can pick up the lighter elements, according to Eimer.

Overriding problem in designing the spectrometer, Miller said, was in maintaining sensitivity required to identify these elements with only 25 watts of power available to the spectrometer in the spacecraft. This involved three important design decisions. First of these was the choice of direct electron excitation of the sample, rather than the use of fluorescent excitation (X-ray tube) with its lower background radiation.

Direct excitation is more efficient however, giving a 1,000 to 1 gain in intensity, and still assuring sufficient sensitivity for determining elements present in significant abundance. A second major choice was the selection of a combination of dispersive optics (using a crystal as an X-ray monochromator to sort out X-rays emanating from the specimen) and non-dispersive optics (electronic discrimination of pulse heights obtained from an energy-sensitive X-ray detector).

The dispersive technique will handle specific radiations, non-dispersive will be for backup and redundancy. Spectrum intensity for a given power is boosted greatly with electronic discrimination although the wavelength resolution is very poor.

The third decision was the selection of an instrument with 15 fixed channels with a pre-aligned crystal monochromator in each channel. This provides 13 signal channels and 2 background channels. The flexibility of scanning type of spectrometer was sacrificed to escape the mechanical complexity of scanning requirement, Miller said.

- **Neutron-gamma ray spectrometer**—Neutron-gamma ray spectrometer, composed of a neutron source and a gamma ray detector, operates independently of geometrical orientation and can completely analyze a bulk lunar sample, according to a report prepared by five scientists of the Lawrence Radiation Laboratory, University of California. The five are C. D. Schrader, J. A. Waggoner, J. H. Zenger, R. J. Stinner and E. F. Martina (now with Aerospace Corp.).

In the source package is a miniature nuclear accelerator which will produce a pulsed beam of 14 Mev neutrons

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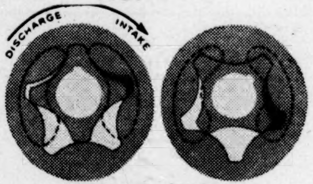
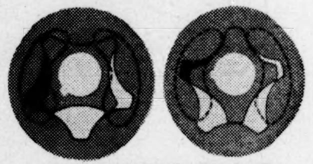
► The rather unusual qualities of the Gerotor pump which have kept it intimately associated with aircraft pumping applications from the days of the earliest superchargers for reciprocating engines, can best be summed up as *inherent adaptability and high reliability.*

FIG. 1



INTAKE CYCLE



DISCHARGE CYCLE

► Structure and operation of the Gerotor pump is relatively simple. The moving elements are the toothed "Gerotors" — inner and outer. Both turn in the same direction and either one may be driven. The inner element always has one less tooth than the outer and the "missing tooth" provides a chamber to move the fluid from the inlet or suction port to the discharge port. (See Figure 1).

► The designer thus has the advantage of several variables to secure a given capacity within his space limitations: *Gerotor diameter*—which governs the area of the pumping chamber—*Gerotor thickness* which, taken with area, determines chamber volume — *Gerotor RPM,* since this is a positive displacement pump. Thus, it is possible to vary the diameter, the length and the speed of the pump within certain overall limits to secure the wanted capacity.

► Unlike conventional gear pumps the Gerotor needs only a *single shaft* — both elements are substantially concentric to it. These are mated to provide continuous, fluid-tight engagement without the crescent structure necessary in other internal gear pumps. Further, Gerotor elements can be stacked along a single shaft and mounted on a single AN pad to perform multiple pump functions: lube, scavenge, boost, etc. (See Figure 2). Such compactness allows the pump to be "submerged" in a gear box or sump and frequently the sump may be part of the pump housing.

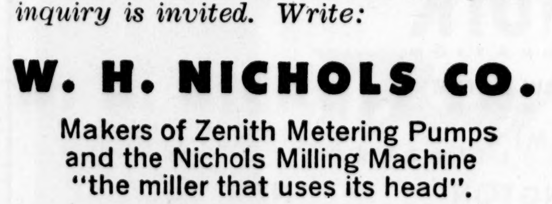


FIG. 2

► *Technical data is available and your inquiry is invited. Write:*

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which will strike the lunar surface and react to produce gamma rays characteristic of the elements present, they told the conference.

Gamma rays impinge on the detector which consists of a scintillator and a rugged photomultiplier tube. Scintillation pulses are stored in a multi-channel pulse height analyzer and the spectrum is telemetered back to earth. Since the instrument will operate on bulk sample, compositional analysis of the surface is assured in the event of a failure in the drill sampler-pulverizer equipment which is to provide samples from beneath the surface.

Quantitative elemental analysis is only one phase of the lunar petrological analysis which also includes mineralogical analysis, visual microscopic examination and determination of volatile constituents, according to Eimer. The miniature X-ray diffractometer also being made by Philips, appears to be the most suitable instrument for making mineralogical analysis of the lunar surface, Eimer indicates. "It is hoped," he says, "that the assemblages of minerals which comprise the samples analyzed will provide diagnostic evidence as to the mode of origin of the chemical system from which the samples were taken."

Primary objectives of the petrographic microscope system, under study by Armour Research Foundation, will be to determine the presence of non-crystalline phases and examine external and internal features of grains and, in fine grain rocks, grain to grain textures. This is the visual microscopic examination.

The only technique being considered for determining volatile constituents of the lunar surface and subsurface samples is a gas chromatography. A report on the application of gas chromatography to the analysis of organics, water and adsorbed gases in the lunar crust was presented at the joint meeting by V. I. Oyama of JPL. Co-authors of the report were S. P. Vango, also of JPL, and E. M. Wilson of Aerojet-General where the lunar chromatograph is being developed for the program.

This device will require approximately 10 watts of power, according to Oyama, with surges of 100 to 150 watts for 10 min. It will scale 11½ lb., be contained in a 8 x 8 x 10 in. package.

In the chromatograph sample, material would be heated and volatiles fractionated simultaneously through three columns—adsorption, partition and partition capillary. Samples are to be heated to various temperatures. The columns will fractionate carbon dioxide, carbon monoxide, nitrogen, hydrogen and methane in the adsorption column; the aromatics—aliphatic alcohol,aliphatic aldehyde, aliphatic ketones, esters and ethers, water and ammonia in the partition column and hydrocarbons, unsaturates, aromatics, cyclids, acids, esters, alcohols, ethers, aldehydes, ketones, substituted aliphatics, halogens, nitrogen, and sulphur in the partition capillary column.

Determination of the physical properties of the moon are of the greatest immediate interest for the design of future lunar spacecraft, Eimer indicates. Texaco Laboratories is conducting a study for JPL, Eimer says, of two systems of instruments—one to be inserted into a prepared hole with instruments stacked one atop the other within a 21-in. probe, the other composed of surface instruments.

These duplicate techniques are under study in the event of difficulty in preparing a hole for the 21-in. probe and also out of interest in the top lunar layer. Among properties to be investigated will be density, hardness, magnetic susceptibility, relative susceptibility, electrical resistivity, speed of propagation, temperature, thermal diffusivity and penetrability.

Density can be measured by gamma-ray backscattering in which a collimated gamma source and collimated counter are placed on or below the surface, Eimer said. Gammas scattered between source and detector are a function of electron density.

Temperature can be measured by a total radiation pyrometer, acoustic properties by recording arrival times, amplitudes, and wave shapes of signals received by geophones, electrical properties by determining changes produced in inductive and capacitive devices placed near lunar material and magnetic susceptibility by finding mutual inductance or its changes caused by presence of lunar material.

Nature of seismic activity on the moon, the natural modes of oscillation, will be determined by a three-axis seismic-exploration instrument, being studied by Lamont Geological Observatory of Columbia University under NASA contract.

Fields, particles, possible atmosphere and ionosphere also will be measured. A JPL-Marshall Industries magnetometer and JPL plasma probe may be employed as will a CalTech-JPL ionization chamber.

Structure of a possible lunar ionosphere can be examined by observing absorption of RF energy, at ¼, ½ and 1 mc. Presence of lunar atmosphere could be measured by a redhead gage (pressure gage) capable of picking up pressures down to 10^{-13} mm. Eimer says JPL probably will choose a redhead gage to be made by JPL, University of Michigan, Goddard, or Geophysical Corp.

Entire cost of the instrumentation studies for the stationary soft-landed vehicles will run into several hundred thousand dollars or several million dollars if flight equipment is included.

FILTER CENTER

▶ **JPL Awards Solar Thermionic Converter Contract**—A 25-lb. solar energy thermionic conversion system, capable of supplying 135 watts for a space vehicle operating near Mars, will be developed by Electra-Optical Systems, Inc., under a $318,303 contract from Jet Propulsion Laboratory. The contract, resulting from an industry-wide competition (AW Feb. 20, p. 33) calls for the design, fabrication and testing of the system which will collect and focus the sun's heat onto the cathodes of cesium vapor thermionic diodes. The diode array will be developed under subcontract by Thermo-Electron Engineering Corp., Waltham, Mass.

▶ **New Radar Range Data Available Soon**—The attenuation of radar signals due to absorption by atmospheric oxygen and water vapor has been calculated by Naval Research Laboratory scientists for a surface radar over the frequency range of 100 to 10,000 mc., as a function of target range and elevation angle, using the Van Vleck theory. Results, in the form of curves useful for calculating maximum radar range, will be published shortly as NRL Report No. 5601, entitled: "Curves of Atmospheric-Absorption Loss for Use in Radar Range Calculation," by L. V. Blake.

▶ **USAF AirCom Specifications Published**—General design and system performance specifications for the Air Force's AirCom (480-L) system, giving over-all objectives and performance specifications in a form suitable for procurement and implementation, has been published by ITT Communication Systems, Inc., Paramus, N. J.

▶ **New Avionic Companies Formed**—Recently formed companies which will operate in the avionics field include:

- **Ryerson Associates, Inc.**, will provide reliability and product assurance consulting services. Company is headed by Clifford M. Ryerson, formerly head of reliability programs for Radio Corp. of America. Address: 400 White Horse Pike, West Collingswood, N. J.
- **Electronic Modules Corp.** will develop and manufacture electronic circuit modules and provide consulting service in the field. Donald W. Ordun is president. Address: 1949 Greenspring Drive, Timonium, Md.
- **American Components, Inc.**, will produce fixed and variable precision film resistors using two new film processes developed by the company. Charles L. Wellard is president. Address: Eighth Ave. and Harry Street, Conshohocken, Pa.

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U. S. Explores Supersonic Airliner Roles

By Erwin J. Bulban

Ft. Worth, Tex.—Design and operational requirements of the supersonic transport indicate that revolutionary rather than evolutionary approaches will be required by the engineer, manufacturer, operator, flight crew and traffic control system, speakers here at a recent Institute of Navigation symposium (AW June 26, p. 40) indicated.

It was apparent that National Aeronautics and Space Administration will play a key role in laying out advanced design parameters— but its representatives here emphasized that industry will carry the greater part of the burden in the research and development program that lies ahead. Federal Aviation Agency tentatively plans to spend about $12 million in Fiscal 1962 with industry to get a full-scale supersonic transport program under way, and indications are that this is only the beginning of government assistance.

FAA Assistant Administrator for Plans, Brig. Gen. Paul T. Preuss emphasized here that a well-organized national effort is required to produce a supersonic transport and acknowledged that, because of the high cost involved, this effort will require government assistance. Roles of government agencies in supporting the national commercial supersonic transport effort will roughly fall in these areas:

- **FAA will provide** program leadership and fiscal support.
- **Department of Defense** will provide knowledge, operating experience, research support and other assistance.
- **NASA will supply** basic research and technical support.

Speed Controversy

The pace of the design discussion was set by John Stack, deputy director of NASA's Langley Research Center, who declared that there are Mach 2 advocates and Mach 3 advocates. . . "I think they're both nuts." The former category would envisage the use of light metals, which limit the airplane's growth capabilities, he noted. Development should envisage an airplane starting somewhere in the Mach 2-Mach 2.5 performance category with capability of growth to Mach 3-Mach 3.5 (AW May 1, p. 103).

Early studies had considered an airframe life of 30,000 hr., but recently, a meeting with airline operators indicated that they foresee a requirement of 50,000 hr.

Steel and titanium alloys look best for an airplane in this category, Stack noted, and NASA has a special group working on materials studies. Contracts have been let with the University of Michigan for research on five stainless steel alloys and with Syracuse University on six super steel alloys.

NASA studies indicate the supersonic transport should be capable of handling holding pattern speeds in the neighborhood of 180-220 kt., function at 120-130 kt. on the instrument landing glide slope, land at approximately 100-110 kt. Speed at V_2 should be approximately 140-150 kt. Noise level limits on takeoff should be held within 100-110 db., he added.

NASA expects to "have enough in the book" in the next 12-18 months to provide industry with firm guidelines on airframe and engine geometry. The agency leans strongly in favor of the variable sweep wing to provide the performance characteristics needed by a supersonic transport capable of functioning within the basic operating parameters indicated by FAA, the airlines and airport operators, Stack indicated.

He revealed that NASA has conducted full-scale structural studies on three variable-geometry wing configurations based on an airframe of about 60,000-lb. gross weight, with several thousand cycles of actuation made successfully.

Among the highlights of the systems is the fact that the mechanism required for sweep actuation weighs less than 2% of the total airframe weight. Actually, there is no penalty, since this geometry provides the airplane with the capability of taking off and landing at much higher gross weights than would be possible with the wing permanently configured to supersonic cruise.

Indications are that the variable-sweep mechanism will be a relatively low maintenance item—Stack pointed out that shoe loadings were found to be below those of the Boeing B-52 wing flap tracks and on two of the systems evaluated, no lubrication was required since this was integral in the components.

A decision must also be made within the next 12-18 months on the optimum engine cycle, Stack stated. Two most prominent types now being actively pursued by Pratt & Whitney and General Electric are the high bypass ratio and turbofan-ramjet configurations, with a particularly critical performance area being a requirement for providing acceleration to provide short takeoff, high angle of climb at subsonic speed to reduce the noise problem and then acceleration into Mach 1 at altitudes of approximately 40,000 ft., building up to Mach 3 cruise at altitudes of about 70,000 ft. or more.

With afterburners out of the picture because of their attendant noise problems, indications are that fan-burning will be employed to provide power boost required for takeoff and climb accelerations.

Stack indicated that unless ways are found to solve severe high temperature problems due to friction, JP-4 and JP-6 turbine fuels do not look very hopeful for the supersonic transport. NASA is starting research on fuel degradation versus thermal severity at its Cleveland laboratory and with industry facilities to determine how much premium is needed in fuel and on keeping fuel cooled in order to reduce necessary premiums to a minimum.

NASA also is putting considerable data into supersonic transport type simulators at its Ames Research Center and is building additional simulators to speed this work. A variable-stability F-100C is being utilized to provide information to back up work being done in the simulators and the Ames tunnel.

Aero-Elasticity Studies

A 9-ft. x 6-ft. tunnel is being utilized in skin friction drag studies. Aero-elasticity is also undergoing considerable study, he noted, with indications being that the supersonic transport's wing must be flutterfree at 1.32 times maximum flight "Q." NASA expects to use a B-58A Hustler bomber later in its program—although its weight is low compared with projected SST designs, it will be very useful in providing data regarding wing loadings, thrust-to-weight ratios required and other essential information.

Concept of a 400,000-450,000 lb. 100-150 passenger Mach 3 transport, apparently derived from the B-70 Valkyrie bomber, was presented by North American Aviation Chief of Preliminary Design Hugh W. Elkin.

The airplane would span 125 ft., have a length of 198 ft. and an over-all height of 31 ft. The wing is the fixed delta-type configuration of the B-70, although Elkin acknowledged that the company also is studying variable-sweep layouts.

Construction would be steel honeycomb. The fuselage would embody an

Hustler Crews Report Problems

Need for improved voice communications is evidenced by the experience of Mach 2 Convair B-58A Hustler crews operating out of Carswell AFB and will be even more critical in the case of the faster supersonic transport. Maj. William R. Payne, 43rd Bomb Wing—pilot of the New York-Paris record-breaking Hustler flight (AW June 12, pp. 108-109)—pointed out these routine communications experiences:

- **The B-58A will pass through the territory of three different centers while talking to the initial one. Maj. Payne felt the present discrete frequency system of reporting requires that the Mach 2 bomber crews have to talk to too many people, requires too much conversation too often and on too many different frequencies.**
- **On low-level flights, at 1,000-ft. altitude, there have been times when he has been unable to contact a single radio facility or center for periods of over an hour, and on reaching a termination point where he was scheduled to climb VFR to a VFR/on-top-condition on an IFR clearance automatically under agreement with the FAA, Maj. Payne has found himself under an overcast and unable to climb within the clearance limits, and unable to make contact with a radio or center.**
- **Inadequate range of the UHF radio was noticeable during his New York to Paris flight, not only in communication with tanker aircraft, but of more interest to the commercial transport operator, on the final leg of the flight. As the B-58A crossed the French coast, Payne was finally able to contact Brettigny radar when he was only seven minutes from termination of his speed run.**

Maj. Payne suggested, on the basis of his Mach 2 experience, that the 300-naut. mi. interval position report be replaced by an interval no less than double this distance. This provides intervals of 30 min., at Mach 2 and 20 min. at Mach 3.

Nor is voice communication the only problem apparent.

Upper air temperature distribution is of critical importance, especially in the supersonic aircraft's acceleration phase, Lt. Col. F. T. McHenry, 26th Weather Sqdn. (MATS), stated, pointing out that a temperature of 2C higher than standard will be costly in fuel consumption and a 6C or higher variation from standard may actually prevent the airplane from ever attaining Mach 2.

The 43rd Bomb Wing's experience has been that the most economical temperature limitations for acceleration and cruise with present engines, is within ±2C of the design temperature profile. This makes it necessary to be able to accurately forecast temperatures to be encountered, he added.

outer skin, insulation and a perforated inner wall to provide transpiration cooling, with outside skin temperature at supersonic cruise of about 450F being reduced by this system so that the inner wall never exceeds 85F. The cabin cooling system would maintain temperature at approximately 72F. Passenger layout would provide four or five abreast in the first-class section and six abreast in tourist area. Cabin loading and exit would be provided by two doors close together to permit feeding passengers in both directions and door sill height above the ground would be about the same as the DC-8 to reduce the need for special loading gear.

Elkin estimated that design and fabrication of the SST prototype would fall in the 1964-1968 time period, with first flight, test and development, and certification in the 1968-1973 period. Based on a unit price of $16.4 million, the North American Aviation airplane would have a direct operating cost of $2.30 per nautical mile and indirect operating cost of $1.90 per nautical mile. Direct operating costs, based on Air Transport Assn. formula, would include cost of $1.15 per nautical mile for fuel, 70 cents for depreciation, 30 cents for maintenance and 15 cents for crew salaries. Utilization is considered at 3,000 hr. annually.

The airplane would be capable of working from a field length of 6,500 ft. at sea level at 100F. Landing speed would be approximately 130 kt. and wing loading at this time would be approximately 35 psf.

The flight profile envisages climbing subsonically to approximately 25,000 ft., then climbing supersonically to cruise altitudes of 70,000-80,000 ft. Typical profile for a 3,500-mi. flight contemplates flying 214 naut. mi. in 27 min. in the air maneuver to the flight corridor—climb cruise at 3,000 fps. for 1 hr. 40 min. and a letdown of 351 naut. mi. taking 29 min.

As a measure of how the SST performance compares with today's subsonic jet transports, Elkin noted that the SST's climbout profile covers about 75 mi. compared with the subsonic jet's 150 mi. and takes only 10 min. compared with today's 30 min. North American estimates that three nautical miles from takeoff, its proposed SST would generate a noise level of 102 db. compared with approximately 112 db. experienced by today's subsonic jet transport 4.5 naut. mi. from takeoff.

Indications were that although advent of supersonic transport operations would not require major technical breakthroughs in the development of new navigation and communications equipment, there would be a need for considerable improvement in today's air traffic control system to cope with the revolutionary increase in performance of these new airplanes—representing, at Mach 3, an increase of 330% over today's speeds.

Participants agreed that unless the traffic control system is developed to handle this new concept, the supersonic transport would be uneconomical to operate or operations would be unsafe.

It appears that the airplanes will utilize self-contained inertial navigation means. It was suggested that for domestic operations an economical system utilizing some ground references could be used. International flights would require more sophisticated and more accurate versions incorporating star-tracking. High cost of these systems probably would be lessened due to the fact that they could replace some of the currently used equipment and so would not necessarily be an expensive addition.

Other possibilities considered included tape programing of the flight plan, with the programmer automatically adjusting controls as needed to maintain the plan, and automatic position reporting to free the crew of the need for frequent diversion to attend to this routine function. The equipment would automatically handle any in-flight changes made in the flight plan after takeoff. Mentioned also was the possibility of utilizing single sideband communications so that the crew could communicate across the country if necessary to confirm their flight plan as they were taxiing out for takeoff.

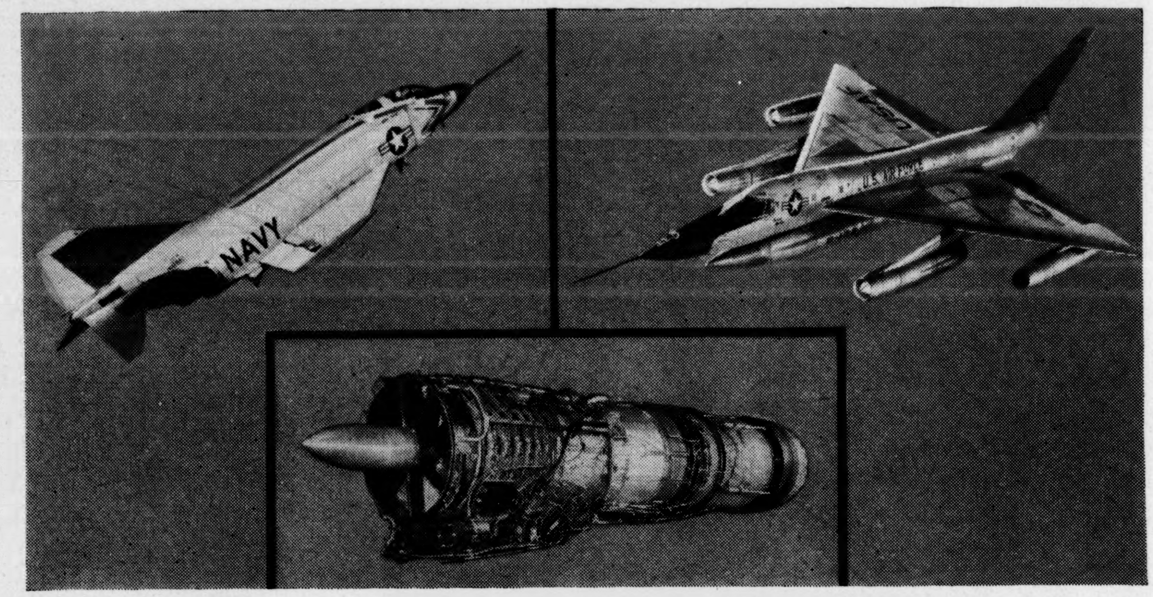
Because of the supersonic transport's requirements for traveling point to point for fuel economy, en route airways' flight as used today will not be feasible, according to Capt. Stan Holm of FAA's office of plans.

At Mach 3, the airplane travels at approximately 30 mi. per minute, he noted, making current methods of primary navigation, such as the VOR with a coverage of about 180 mi., unsuitable. In six minutes from tune-in, the airplane has reached the station.

He also noted that vertical separation of 2,000 ft. with current pressure altimeters is not considered acceptable for altitudes over 60,000 ft. Indications are that improved altimetry equipment with instrumentation incorporating null servo-type altimeters and improved air data computer systems may permit vertical separation of 1,000 ft. at the highest altitudes expected for cruise.

High speeds of the airplane would take it through en route centers so rapidly that the controller would have little time for control, he noted. For high-altitude control, en route facilities must be provided to permit the SST to be kept under the control of a single facility for a longer period.

Flight Propulsio



The month of May witnessed new records set by the McDonnell F4H fighter (left) and Convair's B-58 bomber (right). Both are powered by G-E Mach 2+ J79 turbojets.

McDONNELL, CONVAIR JETS SET NEW MARKS

CINCINNATI, Ohio—Two U.S. Mach 2+ aircraft, powered by General Electric's J79 turbojet, added to their long array of records by logging three new Jet Age milestones during the month of May.

Within a three-week period, a U.S. Navy McDonnell F4H won the Bendix Trophy while smashing cross-country speed records, a Convair B-58 clinched the long-unclaimed Bleriot Trophy, and another B-58 flew a supersonic version of the historic Lindbergh flight.

The Bendix Trophy classic, the first held since 1957, witnessed three U.S. Navy F4H Phantom II's streak from Ontario International Airport in California to New York's Floyd Bennett Field, with the fastest aircraft arriving in two hours and 47 minutes. All three of the J79-powered Phantom II's bettered the previous cross-country record of three hours and seven minutes.

Earlier in the month a U.S. Air Force B-58 Hustler sustained a speed of 1302 mph for 30 minutes and 45 seconds over a rectangular closed course to qualify for permanent possession of the Bleroit Trophy.

Awarded by the Aero Club of France, the trophy had stood unclaimed since 1930 when it was offered to the first aircraft that could hold a speed of 2000 kilometers per hour (1243 mph) for 30 minutes.

The Hustler bomber, which was powered by four G-E J79 turbojets, was flown by a crew of the USAF Strategic Air Command's 43rd Bomb Wing from Carswell AFB, Texas.

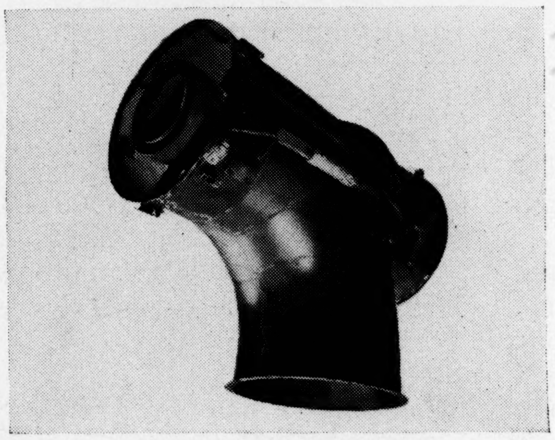
Two weeks later another G.E.-powered Convair Hustler reenacted one of the most significant events in world aviation history when it flew over the Spirit of St. Louis New York-Paris route at almost Mach 2 speeds. Flying time was three hours, 19 minutes and 41 seconds, slightly more than 1/10th of the 33½ hours required for the 1927 flight.

V/STOL Diverter Valve Proven Successful in Tests

CINCINNATI, Ohio—A low-cost, lightweight valve that efficiently diverts engine exhaust flow to propel V/STOL aircraft has been built and tested successfully by General Electric's Flight Propulsion Laboratory Department here.

Added to a standard gas-generator as an exhaust-nozzle attachment, the valve permits exhaust gas to be employed for either horizontal flight or lifting purposes. The valve is designed so that exhaust gas may flow straight through or be diverted 90 degrees to power direct lift or lift-fan aircraft.

Tests of full-scale valves have shown turning losses to be low. Thirty-one hours of engine testing included 13 hours above 95% speed and four five-hour endurance cycles without failure or performance deterioration.



Further tests at Evendale have evaluated diverter valve performance during static testing of the G.E. lift-fan system. Full-scale fan-in-wing VTOL aircraft wind tunnel tests at NASA Ames will be conducted later this year.

TWA, NEA Increase TBOs

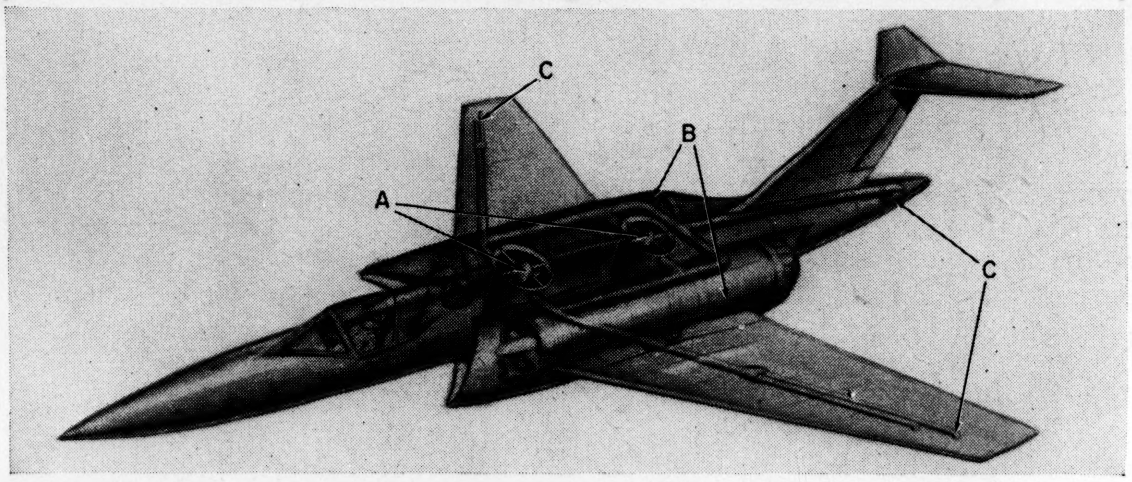
CINCINNATI, Ohio—Trans World Airlines and Northeast Airlines have received FAA approval to increase Time Between Overhaul to 1000 hours for their CJ-805-3 turbojet engines.

The General Electric CJ-805-3's had been in service for roughly four months, powering the two airlines' Convair 880 jetliners.

Commented T. J. Harris, G.E.'s manager of Commercial Engine Maintenance and Operations Engineering, "This rate of advance in allowable time between overhaul is extremely rapid from an industry standpoint."

Under the FAA's Turbine Engine Time Control Program, the G-E turbojets are now considered "substantially experienced" engines. This means that all subsequent operators of the Convair 880 will be able to enter service with an initial TBO of 1000 hours. The new authorization was effective May 1.

Direct-lift VTOL Engines Under Study



This VTOL direct-lift propulsion system, used in conjunction with primary turbojets, is being considered for supersonic aircraft of the future. Applicable high-thrust, lightweight direct-lift engines are currently under study at General Electric.

During takeoff and landing, vertical thrust is provided both by small direct-lift turbojets (A), and primary engines (B) using diverter valves. Bleed air directed to the wings and tail (C) controls stability. After transition to horizontal flight, the direct-lift turbojets will cut power and the primary powerplant will propel the aircraft at supersonic speeds.

NEWS

A report about progress in research and products from the Flight Propulsion Division of the General Electric Company

New Engine Test System Is Movable, Economical

CINCINNATI, Ohio — A semi-permanent jet engine test system that can provide airlines with initial cost savings of approximately one-half to two-thirds over permanent concrete cells is now being offered by General Electric's Los Angeles Aircraft Service Shop.

Ideal for engine trouble-shooting and post-overhaul checkout, its performance compares favorably with that of permanent concrete type cells. It can readily be relocated or added to, providing flexibility and economies not feasible with permanent cells.

A prototype cell is in operation at G.E.'s Aircraft Service Shop in Linden, N. J., where it is being used for overhaul and trouble shooting of Convair 880 CJ-805-3 engines. Its design also permits accommodation of all other turbojet and turbofan engines of any manufacturer.

The system is supplied with an air-conditioned control house containing instrumentation and engine operating controls. Aluminum construction assures durability, and space is ample for operators and attendants. Instruments are readily accessible via a walk-in area behind the control panel.

The engine-run room was developed jointly with the Koppers Company, a leader in the field of jet engine sound control. Easily assembled, it resembles permanent concrete cells in shape and dimension. Room inlet and exhaust silencers are constructed of steel plate.

Complete information about these test cell facilities can be obtained by contacting the General Electric Company, Aircraft Service Shop, Ontario International Airport, Ontario, Calif.

G-E powered S-62 turbocopter is now providing speedy Bay Area shuttle service.

Turbocopter Service Inaugurated in San Francisco-Oakland Bay Area

SAN FRANCISCO, Calif.—Sikorsky S-62 turbocopter passenger service was recently inaugurated here by San Francisco & Oakland Helicopter Airlines.

Initially, the airline plans service between downtown San Francisco and Oakland heliports, San Francisco and Metropolitan Oakland International Airports, and Berkeley and Palo Alto. The General Electric CT58-powered turbocopters will traverse these routes in flying times ranging from four to 12 minutes.

According to Airline President M. F. Bagan, the inauguration climaxes more than 10 years of effort by San Francisco and Oakland to introduce passenger helicopter service similar to that enjoyed by Los Angeles, Chicago, and New York.

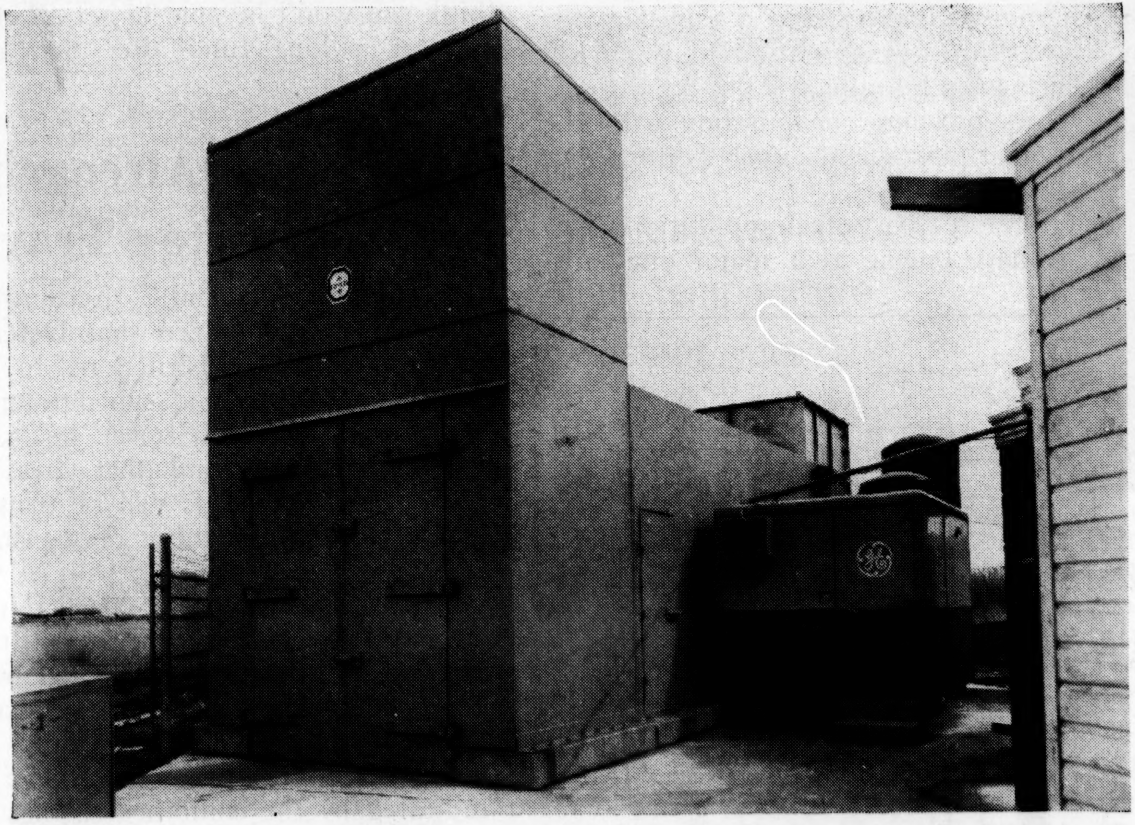
"Our Bay Area operation," Bagan said, "is going to be watched carefully. Unlike other scheduled helicopter carriers, we are starting on a non-subsidy basis. If our belief that the Bay Area has the potential to support self-sufficient helicopter service proves correct, the long-heralded era of the helicopter could well become part of the scene in all major cities in the country."

Commenting on the Sikorsky S-62 helicopter, Bagan said: "Its turbine power gives it smooth comfort and speed. The excellent power-weight ratio of the General Electric CT58 engine and the 10-year-proven blades and components of this aircraft make it the most dependable helicopter ever built."

Sikorsky HSS-2 Sets Speed Record

WASHINGTON, D.C.—A U.S. Navy Sikorsky HSS-2 turbocopter recently claimed a new helicopter world speed record of 192.9 mph. Fastest speed was previously 167 mph, a record claimed by the Russian Mil-6 in 1959.

The advanced submarine hunter-killer weapon system, powered by two General Electric T58 gas turbine engines, will soon enter USN fleet service.



Typical of General Electric's new semi-permanent engine test system is this unit in use at G.E.'s Linden (N. J.) Aircraft Service Shop. The small control house contains equipment needed to check out engines tested in the run-room at left.

FOR MORE INFORMATION

General Electric Company, Section A206-32, Schenectady, N. Y.: Please send me more information on______

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GENERAL ELECTRIC

GE Proposes Mid-1962 Deliveries Of 3,050-lb.-Thrust Lift Engine

By David A. Anderton

Lynn, Mass.—Thrust-weight ratio of 10.3, claimed higher than that of any other engine deliverable by mid-1962, was a major design goal for General Electric's SJ132 lift engine.

The new powerplant, developed by the company's Small Aircraft Engine Dept. here, has a rated thrust of 3,050 lb. at sea level for a weight of 295 lb., including self-contained lubrication system, fuel control and engine-mounted fuel pump. Guaranteed maximum specific fuel consumption is 1.00 lb./lb./hr.

Primary aim in the design of the SJ132 was to produce an auxiliary lifting engine with a thrust-weight ratio that could not be beaten by any current contender, or by any other engine deliverable in the same time period. The company says it can make shipments within one year after receiving the go-ahead order.

The SJ132 engine is 37 in. over-all and has a maximum envelope height of 23.61 in. and width of 19.36 in., all nominal cold dimensions. (Nominal cold dimensions specify the size of the engine under standard conditions; it grows, as do all jet engines, when it is hot and running.)

The SJ132—and its still-secret sister, the SJ133—are considered as members of the company's J85 family (AW Apr. 17, p. 131). The new lift engines use basic J85 gas generator components; specifically, the SJ132 has a J85-GE-7 front end and a J85-GE-5 hot end.

The company engineers started with the engine configuration of the -7, the high-altitude missile engine used in the McDonnell GAM-72A Quail. The high-altitude ethylene oxide starting system was removed and the oil tank shape was changed to reduce its envelope.

Hot end of the J85-GE-5, an afterburner engine now installed in Northrop T-38 trainers and the Radioplane Q-4B supersonic drones, was adapted to the SJ132. Turbine outlet temperatures have been increased by about 40F over the values for which the J85-GE-5 was qualified in 150-hr. testing.

Changes in engine components have been almost unnecessary; lubrication system scavenging is one area which had to be worked on, because of the unique problem imposed by vertical operation.

Engine can provide bleed air up to 10% of the mass flow, for operation of jet reaction control systems on VTOL vehicles.

Air-impingement starting is used, with a standard MAIIA start cart supplying the air to turn over the turbine. The SJ132 may be started either in the vertical or horizontal position, may be turned from either position when running and may be operated at any intermediate position.

Proving Concepts

SAED engineers believe that the biggest advantage of the SJ132 program is that it supplies a lift engine now for proving or evaluating some of the concepts in the VTOL field. They point out that many basically good ideas have suffered in the past because of the lack of a high enough thrust-weight ratio powerplant to do the job properly.

They contrast the performance of one such vehicle, the deflected-jet Bell X-14A vehicle, now on flight status with National Aeronautics and Space Administration. The X-14A, re-engined with a pair of J85-5 engines without afterburners—which have a substantially lower thrust-weight ratio than the SJ132—has been hovered at 5,000-ft. altitude. In its previous configuration with the original powerplants, such performance was impossible.

Because conceptual application as an auxiliary engine is a major one envisioned for the SJ132, the engine is currently considered as a 50-hr. powerplant.

Current GE timetable for the SJ132 schedules parts production for six months after the go-ahead. At the nine-month marker, qualification tests and vertical demonstration would be run.

Shipment of engines would start one year after the go-ahead.

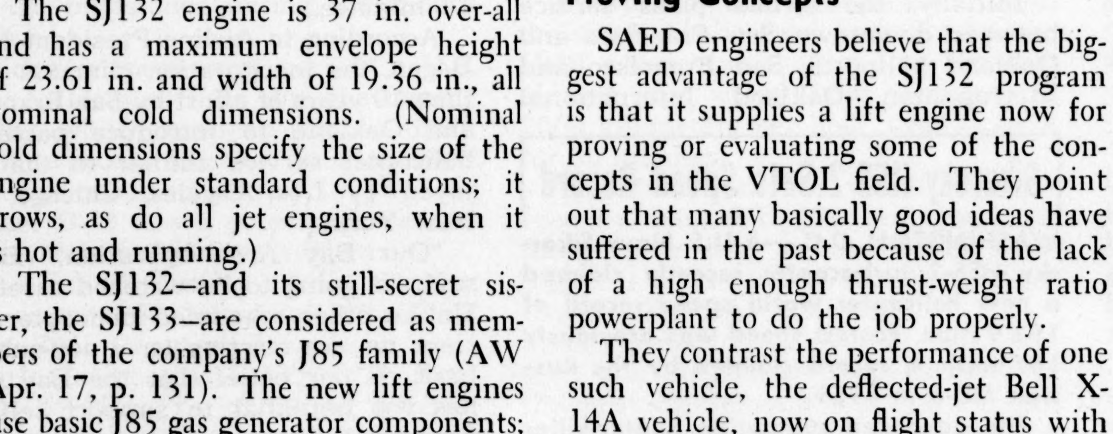
This means, of course, that there is no such thing right now as a tangible SJ132 engine. But all the components are tangible and not only in existence, but in high-rate production. About 80 J85 engines—half and half -5 and -7 models—leave the Lynn plant every month.

Standard components could be pulled out of these lines, modified where necessary and assembled into a batch of SJ132s for qualification runs.

Program costs have been estimated in the area of a few hundred thousand dollars, says one GE engineer. For this price, the customer could start the assembly line and have a few engines to test for himself.

Total engine time logged on the J85 family stands now at about the 30,000-hr. mark. From now on, time will accumulate at a high rate, as Air Training Command begins to rack up long hours on its Northrop T-38 Talons. But at this stage, there is enough time on the J85 engines to make engineers feel confident that nothing unusual will crop up during runs of the SJ132.

"There's nothing left to do now but assemble and test the engine," said an engineer, "and we'll do that and deliver it to you in one year at the most. You won't get any other lift engine from anybody anywhere at a better thrust-weight ratio before that time, and we think you won't be able to get a better one for a long time after that one year."



GENERAL ELECTRIC SJ132 lift engine, rated at 3,050 lb. thrust at sea level, weighs 295 lb. Nominal cold dimensions are given in drawing.

GAO Urges Aircoach For Contractor Travel

Washington—General Accounting Office has recommended that Defense Department issue instructions to all defense contractors and subcontractors urging that aircoach travel be used whenever practical and that "reasonableness of travel costs will be considered in the negotiation of contract prices."

Reporting on the use of coach travel, GAO said it had found some contractors who had voluntarily adopted policies encouraging employes to use coach flights. It added that the extent of savings stemming from this move is "indicated by the combined savings of more than $1 million experienced in 1960 by only two contractors."

Defense Lists 100 Top 1960 Contractors

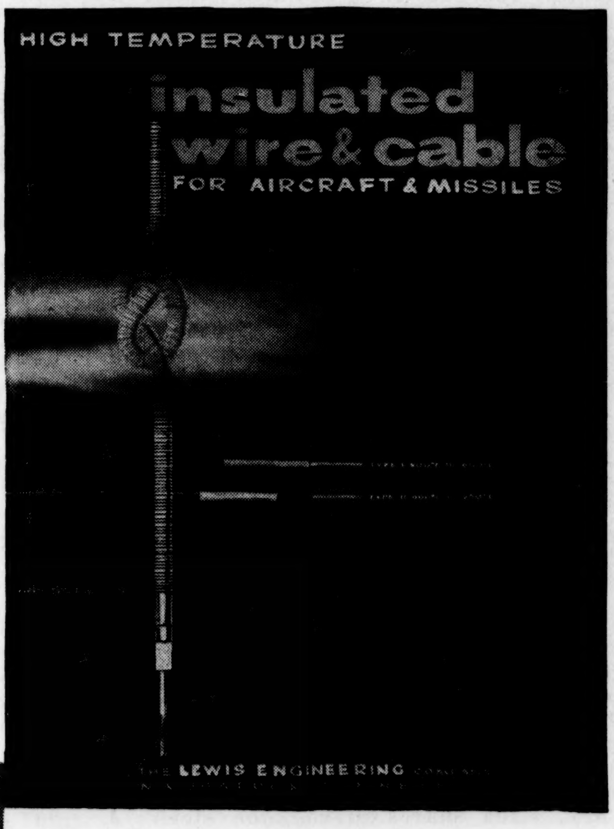
Washington—Aerospace and electronics companies continue to dominate the list of the top 100 defense contractors, which won 75% of the $21.6 billion in military prime contracts awarded in 1960.

The roster includes 61 companies involved in prime contract work on research, development and production of aircraft, missile systems or electronics. There are seven new companies in this category on the calendar 1960 list, and eight aerospace and electronics companies which were on the 1959 list failed to win enough contracts to be included in 1960.

The top 100 companies' share of total contracts increased from 74% in 1958 and 73.2% in 1959 to 74.6% last year. The Defense Department attributes this rise to mergers and acquisitions which consolidated the defense business of several firms. Two examples are Textron's purchase of Bell Aircraft Corporation's defense business and the merger which produced Ling-Temco Electronics.

The top 100 companies and their 135 subsidiaries received $16.148 billion in 1960 military prime contract awards worth $10,000 or more. Defense awarded a total of $21.643 billion in contracts of this type last year. The 100 companies are:

Companies	Millions of Dollars	Percent of Total
1. General Dynamics....	1,294.7	6.0
2. Lockheed Aircraft....	1,124.3	5.2
3. North American Aviation	964.1	4.4
4. General Electric......	944.7	4.4
5. Boeing Co.	867.1	4.0
6. United Aircraft	739.1	3.4
7. Martin Co.	708.4	3.3
8. AT&T	501.9	2.3
9. Hughes Aircraft	437.6	2.0
10. Raytheon Co.	374.2	1.8
11. RCA	364.8	1.7
12. Douglas Aircraft.....	353.5	1.6
13. Grumman Aircraft ..	336.6	1.5
14. Republic Aviation....	323.3	1.5
15. Sperry-Rand Corp....	318.0	1.5
16. International Business Machines Corp......	312.1	1.4
17. Newport News Ship Building & Dry Dock	302.4	1.4
18. Bendix Corp.	274.3	1.3
19. Westinghouse Electric.	269.5	1.3
20. General Tire & Rubber	257.8	1.1
21. General Motors Corp..	214.0	1.0
22. Chrysler Corp.	199.5	1.0
23. Avco Corp.	193.2	0.9
24. IT&T	188.3	0.8
25. Standard Oil Co. (New Jersey)	163.7	0.8
26. Northrop Corp.	158.0	0.7
27. Thiokol Chemical....	140.1	0.6
28. Burroughs Corp......	122.7	0.6
29. Chance Vought.......	120.6	0.6
30. Hercules Powder	118.8	0.5
31. McDonnell Aircraft...	118.8	0.5
32. Pan American World Airways	109.1	0.5
33. Philco Corp.	101.4	0.5
34. Thompson Ramo Wooldridge	100.9	0.5
35. Collins Radio Co.....	99.0	0.4
36. Standard Oil Co. of California	96.9	0.4
37. Minneapolis-Honeywell Regulator Co.	84.3	0.4
38 American Machine and Foundry Co.	83.9	0.4
39. General Precision Equipment Corp....	83.0	0.4
40. American Bosch Arma	82.4	0.4
41. MIT	80.9	0.4
42. Garrett Corp.........	80.8	0.4
43. Textron	78.1	0.4
44. Ling-Temco Electronics	76.9	0.3
45. Kaiser-Raymond-Macco-Puget Sound.	75.4	0.3
46. Texaco	74.3	0.3
47. Curtiss-Wright Corp..	67.1	0.3
48. Goodyear Tire & Rubber Co.	64.3	0.3
49. Food Machinery & Chemical Corp......	62.6	0.3
50. Continental Motors ..	62.4	0.3
51. Ryan Aeronautical Co.	56.2	0.3
52. du Pont (E. I.) de Nemours & Co......	55.4	0.3
53. Olin Mathieson Chemical Corp.	53.4	0.3
54. Kiewit (Peter) Sons'	52.7	0.3
55. General Telephone & Electronics Corp....	52.6	0.2
56. Shell Caribbean Petroleum Co.........	51.7	0.2
57. Merritt-Chapman & Scott Corp.	49.2	0.2
58. Laboratory for Electronics	48.9	0.2
59. Socony Mobil Oil Co..	47.1	0.2
60. Marquardt Corp......	46.3	0.2
61. Bethlehem Steel......	45.3	0.2
62. Lear	43.7	0.2
63. Magnavox Co.	43.5	0.2
64. Northern Pump Co...	43.1	0.2
65. Mason & Hanger-Silas Mason Co.	42.6	0.2
66. Sanders Associates...	41.9	0.2
67. Todd Shipyards......	40.0	0.2
68. Motorola	38.0	0.2
69. Kaman Aircraft......	36.5	0.2
70. Ford Motor Co.......	36.2	0.2
71. Ingalls Iron Works Co.	35.0	0.2
72. Richfield Oil Corp....	34.1	0.2
73. System Development..	32.8	0.2
74. Union Carbide Corp..	32.0	0.2
75. Universal American..	31.3	0.2
76. Fairchild Engine & Airplane Corp.	30.8	0.2
77. Continental Oil Co. (Delaware)	29.9	0.2
78. Goodrich (B. F.) Co..	29.9	0.2
79. Standard Oil Co. (Indiana)	29.5	0.1
80. Gulf Oil Corp........	29.5	0.1
81. Firestone Tire & Rubber Co.	29.4	0.1
82. International Harvester Co.	29.0	0.1
83. Vitro Corp. of America	28.7	0.1
84. Gilfillan Bros.	28.6	0.1
85. Cook Electric Co.....	28.3	0.1
86. Air Products	27.8	0.1
87. Sinclair Oil	27.8	0.1
88. Jones-Teter-Winkelman	27.8	0.1
89. Johns Hopkins University	27.7	0.1
90. Utah-Manhattan-Sundt	27.3	0.1
91. Litton Industries.....	27.2	0.1
92. Hallicrafters Co.	26.9	0.1
93. Cities Service Co.....	26.2	0.1
94. Morrison-Knudsen Co.	26.1	0.1
95. States Marine Corp...	26.0	0.1
96. A R O, Inc..........	25.9	0.1
97. Hazeltine Corp.	25.0	0.1
98. Union Oil Co. of California	24.6	0.1
99. Western Contracting..	24.2	0.1
100. Sunray Mid-Continent Oil Co.	24.1	0.1



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Aerospace Firms List Officers' Salaries

Washington—Following is a list of aerospace industry directors and officers with 1960 salaries above $30,000 and their stockholdings, as reported to the Securities and Exchange Commission:

Aeronca Manufacturing Corp.—J. A. Lawler, president and director, $60,000 salary, 39,875 shares of common stock; **S. H. Badgett**, group vice president-commercial products, $38,500 salary; **S. J. Kuderer**, vice president-finance, secretary-treasurer and director, $35,000 salary, 2,275 shares of common stock; **R. A. Dadisman**, director, 995 shares of common stock; **F. D. Danford**, director, 7,822 shares of common stock; **G. C. Hill**, director, 525 shares of common stock; **E. S. Myers**, director, 262 shares of common stock and 1,300 shares of 5.5% preferred stock in the name of others; **J. Slezak**, director, 105 shares of common stock; **M. S. Smith**, director, 6,022 shares of common stock, 2,311 shares of 5.5% preferred stock. Stocks are listed as of Mar. 1, 1961.

American Bosch Arma Corp.—C. W. Perelle, president and director, $140,000 salary, 10,100 shares of common stock; **C. A. Sharpe**, senior vice president, $55,000 salary; **V. Charles Schorlemmer**, vice president, $46,000 salary; **C. Allen, Jr.**, director, 40,457 shares of common stock in the name of others; **F. W. Harder**, director, 8,600 shares of common stock; **J. L. Holtzmann**, director, 1,172 shares of common stock; **R. F. Peo**, director, 671 shares of common stock; **M. L. Sindeband**, director, 132 shares of common stock; **C. G. Terry**, director, 732 shares of common stock; **G. C. Textor**, director, 135 shares of common stock; **W. S. Wasserman**, director, 606 shares of common stock. Stocks are listed as of Mar. 1, 1961.

American Machine & Foundry Co.—C. L. Burgess, president and director, $94,850 salary, 4,100 shares of common stock; **F. P. Downey**, vice president and director, $81,300 salary, 11,840 shares of common stock; **R. C. Gott**, executive vice president and director, $93,600 salary, 6,878 shares of common stock; **G. S. Hastings**, vice president and director, $46,315 salary, 2,715 shares of common stock; **G. S. Hills**, general counsel and director, $27,328 salary, 3,872 shares of common stock; **M. McConnel**, director, $54,442 salary, 22,300 shares of common stock.

D. S. Meiklejohn, vice president, treasurer and director, $70,972 salary, 5,956 shares of common stock; **M. Patterson**, chairman of the board, $158,450 salary, 52,606 shares of common stock; **W. B. Smith**, vice chairman of the board, $59,575 salary, 18,809 shares of common stock; **M. D. Sprague**, vice president and director, 59,700 salary, 1,060 shares of common stock. Stocks are listed as of Jan. 31, 1961.

Beech Aircraft Corp.—A. Beech, president, $119,658 salary, 237,024 shares of common stock; **F. E. Hedrick**, executive vice president and director, $86,581 salary, 32,310 shares of common stock; **J. A. Elliot**, secretary-treasurer and director, $42,353 salary, 5,208 shares of common stock; **J. P. Gaty**, vice president, general manager and director (until Sept. 30, 1960), $56,670 salary; **J. N. Lew**, vice president-engineering and director (from 1960), 4,200 shares of common stock; **W. L. Henry**, vice president-marketing and director (from 1960), 504 shares of common stock; **L. L. Greever**, vice president-domestic sales and director, (from 1960), 7,548 shares of common stock; **A. R. Bell**, director (from 1960), no stock; **D. S. Wallace**, director, 17,103 shares of common stock. Salaries are listed for the fiscal year ending Sept. 30, 1960, and stocks are listed as of Dec. 1, 1960.

Bendix Corp.—M. P. Ferguson, president and director, $161,849 salary, 2,148 shares of common stock; **P. Fontaine**, executive vice president and director, $74,349 salary, 1,183 shares of common stock; **E. K. Foster**, vice president and director, $83,749 salary, 1,260 shares of common stock; **W. H. Houghton**, vice president, treasurer and director, $88,350 salary, 7,523 shares of common stock.

R. P. Lansing, vice president and director, $92,400 salary, 6,779 shares of common stock; **C. Marcus**, director, $84,200 salary; **L. F. Polk**, vice president and director, $41,827 salary, 7,830 shares of common stock; **G. E. Stoll**, executive vice president and director, $106,850 salary, 6,348 shares of common stock; **C. C. Tillinghast, Jr.**, vice president and director, $59,422 salary, 523 shares of common stock. Salaries are listed for the fiscal year ending Sept. 30, 1960, and stocks are listed as of Jan. 14, 1961.

Boeing Co.—W. M. Allen, president, $115,901 salary, 12,561 shares of common stock; **W. E. Beall**, senior vice president, $82,733 salary, 5,595 shares of common stock; **F. P. Laudan**, vice president-manufacturing, $40,887 salary, 9,009 shares of common stock, $20,000 convertible debentures; **E. C. Wells**, vice president-engineering, $71,050 salary, 3,915 shares of common stock.

J. O. Yeasting, vice president, general manager-transport division, $55,537 salary, 3,272 shares of common stock; **D. Corbet**, director, 674 shares of common stock, $2,700 convertible debentures; **C. L. Egtvedt**, director, 18,898 shares of common stock; **D. A. Forward**, 530 shares of common stock, $2,200 convertible debentures; **A. L. Gates**, director, 648 shares of common stock; **J. E. Schaefer**, director, 1,000 shares of common stock; **D. Schmitz**, director, 5,406 shares of common stock; **W. G. Reed**, director, 1,446 shares of common stock. Stocks are listed as of Feb. 1, 1961.

Borg-Warner Corp.—R. C. Ingersoll, chairman of the board, $123,438 salary, 5,500 shares of common stock; **R. S. Ingersoll**, president and chief executive officer, $153,750 salary, 2,000 shares of common stock; **L. G. Porter**, executive vice president, $133,125 salary, 2,164 shares of common stock; **R. W. Murphy** vice president, general counsel and chairman of executive committee, $105,625 salary, 986 shares of common stock; **A. Steg**, vice president and treasurer, $105,625 salary, **E. S. Russey**, president and general manager-Warner Gear Division, 2,200 shares of common stock.

E. F. Ball, director, 23,350 shares of common stock; **C. S. Davis, Jr.**, director, 7,772 shares of common stock; **P. H. Davis**, director; **A. E. Duncan**, director, 13,564 shares of common stock; **J. R. Forgan**, director, 300 shares of common stock; **G. A. Freeman, Jr.**, director, 100 shares of common stock; **H. G. Ingersoll**, director, 5,035 shares of common stock; **W. G. Karnes**, director, 100 shares of common stock; **J. Madden**, director, 100 shares of common stock; **G. S. Moore**, director, 100 shares of common stock. Stocks are listed as of Mar. 1, 1961.

Cessna Aircraft Co.—D. L. Wallace, president and director, $96,000 salary, 159,207 shares of common stock; **F. A. Boettger**, vice president, treasurer and director, $70,200 salary, 27,141 shares of common stock; **D. L. Roskam**, vice president-aircraft divisions and director, $68,640, salary, 19,117 shares of common stock; **T. B. Salter**, vice president-engineering and director, $43,680 salary; **S. Coleman**, director, 3,120 shares of common stock; **R. E. Dillon**, director, 300 shares of common stock; **H. P. Quinn**, director, 60 shares of common stock; **R. Russell**, director, 3,384 shares of common stock. Salaries are listed for fiscal year ending Sept. 30, 1960, and stocks are listed as of Nov. 1, 1960.

Curtiss-Wright Corp.—T. R. Berner, chairman, president and director, $60,683 salary, 2,400 shares of common stock; **R. T. Hurley**, chairman, president and director (until May 25, 1960), $224,850 salary (including awards from prior years); **G. R. Hill**, executive vice president, vice president-finance and director, $173,000 salary; **J. G. Byron**, executive vice president and director, $95,300 salary, 900 shares of common stock.

J. V. Miccio, vice president and general manager-aeronautical division, $118,000 salary; **F. T. Lane**, director (since June 29, 1960), 1,500 shares of common stock; **E. McSweeney**, director (since Aug. 17, 1960), 100 shares of common stock; **C. D. Perkins**, director (on leave after Mar. 1, 1960), 50 shares of common stock; **D. C. Power**, director, 100 shares of common stock; **L. H. Smith**, director, 100 shares of common stock; **E. E. White**, director (since Dec. 7, 1960), 100 shares of common stock. Stocks are listed as of Mar. 3, 1961.

Fairchild Engine and Airplane Corp.—J. H. Carmichael, president and director (until Oct. 5, 1960), $63,750 salary; **F. E. Newbold, Jr.**, vice president and director, $51,334 salary, 110 shares of common stock; **W. L. Landers**, vice president (until July 14, 1960), $53,306 salary; **W. F. Burke, Jr.**, director (since Oct. 5, 1960), 700 shares of common stock; **C. H. Colvin**, director, 263 shares of common stock; **C. L. DeOrsey**, director, 1,000 shares of common stock; **S. M. Fairchild**, director, 104,559 shares of common stock; **F. R. Nichols**, director, 3,230 shares of common stock; **R. S. Stillman**, director, 100 shares of common stock; **J. B. Wharton, Jr.**, director (since Oct. 5, 1960), 100 shares of common stock. Stocks are listed as of Feb. 15, 1961.

Grumman Aircraft Engineering Corp.—L. R. Grumman, chairman of the board, $65,400 salary, 128,940 shares of common stock; **L. A. Swirbul**, president and director (deceased June 28, 1960), $57,500 salary; **W. T. Schwendler**, senior vice president, chairman of executive committee and director, $65,500 salary, 47,300 shares of common stock; **E. C. Towl**, administrative vice president, president and director, $65,500 salary 8,000 shares of common stock; **C. A. Wight**, director, 1,000 shares of common stock; **J. L. Collyer**, director, 100 shares of common stock. Stocks are listed as of Feb. 1, 1961.

Helio Aircraft Corp.—No officers received more than $30,000 aggregate remuneration during 1960. Total officers' salaries and commissions for 1960 were $37,812. Following is a list of officers' and directors' stockholdings: **L. L. Bollinger**, president, treasurer and director, 24,313 shares of common stock, 182 shares of preferred stock; **S. L. Baring-Gould**, director, no stock; **E. B. Berlinrut**, director, 5,050 shares of common stock; **C. E. Ford**, director, no stock; **W. M. Joy**, director, 5,000 shares of common stock; **R. B. Kimnach**, vice president and director, 1,000 shares of common stock; **O. C. Koppen**, director, 12,516 shares of common stock, 80 shares of preferred stock; **C. A. Rheinstrom**, director, 5,400 shares of common stock; **L. Stewart**, director, no stock. Stocks are listed as of Mar. 31, 1961.

Marquardt Corp.—R. E. Marquardt, president and director, $70,424 salary, 60,634 shares of capital stock; **D. L. Walter**, vice president and director, $46,952 salary, 3,781 shares of capital stock; **W. H. Schwebel**, vice president, treasurer and director, $42,482 salary, 630 shares of capital stock; **B. A. Gilles**, director; **H. A. Klagsbrunn**, director, 620 shares of capital stock; **F. Lindvall**, director (since Mar. 1, 1960); **W. Littlewood**, director (since Mar. 1, 1960), 200 shares of capital stock; **C. B. Millikan**, director, 3,410 shares of capital stock; **C. B. Unterberg**, director; **T. F. Walkowicz**, director; **H. Woodward**, director, 3,250 shares of capital stock. Stocks are listed as of Mar. 1, 1961.

AMC Contracts

Wright-Patterson AFB, Ohio—Following is a list of unclassified contracts for $25,000 and over as released by the Air Materiel Command Aeronautical Systems Center:

Utah Division, Thiokol Chemical Corp., Brigham City, Utah, TUX-1S140 ignition systems for M16E3 rocket motors, iaw contractor's specification TUS-59-75, dated 6 Jul. 60, amendment No. 1, dated 16 Dec. 60, to contract AF 33(600) 42513, 183 ea., $124,850.

The Geotechnical Corp., Garland, Tex., project authorization VT/074 amendment No. 3 (seismographic station for Project VELA) letter contract designated supplemental agreement No. 1, dated 2 Feb. 61, to contract AF 33(600)41694, $2,000,000.

GPL Division, General Precision, Inc., Pleasantville, N. Y., varying quantities of components of APN-81 and APN-82 radar systems, and data, (Use: KC-135 and B-52 aircraft) letter contract AF 33(600)42556, dated 19 Jan. 61, $164,972.

Chicago Aerial Industries, Inc., Barrington, Ill., Type KA46 aerial reconnaissance camera, still picture, with carrying case, 150 ea., installation kits, 102 ea., film cassettes, 250 ft. 150 ea., test control unit, 1 ea., handbooks, spare parts and related data, IFB 33-600-61-147, contract AF 33(600) 42647, dated Feb. 61, $14,833,415.

Hughes Aircraft Co., Culver City, Calif., installation support services and engineering support services for MA-1 aircraft weapons control system used on F-106 aircraft, supplemental agreement No. 14, dated 23 Dec. 60, to contract AF 33(600)39692, $110,157.

West Coast Missile & Surface Division, Radio Corp. of America, Van Nuys, Calif., various components of radar set AN/APN-70, spare parts and data, letter contract AF 33(600)42371, dated 12 Dec. 60, $140,042.

Hughes Aircraft Co., Culver City, Calif.. support for Category III Test Program on MA-1 fire control system and GAR-3A/-4A missiles, and data, (used on the F-106 aircraft) letter contract AF 33(600)-42559, dtd 9 Jan. 61, $280,000.

Gordon Enterprises, North Hollywood, Calif., various quantities of spare parts for aerial cameras, (applicable to Type O-15, T-11, K-20 and K-17C cameras) contract AF 33(600)-42710, dtd 24 Jan. 61, $28,506.

Capehart Corp., Richmond Hill, N. Y., filter, band pass, band suspension F-339/A, iaw/Spec MIL-F-25880A, dtd 29 Jan. 60, FSN 5915-670-0698, Aerno: 81-3106, and data. (Usage: USAF installations and spares) IFB 33-600-61-143, contract AF 33(600)-42771, dtd 24 Feb. 61, 361 ea., $27,207.

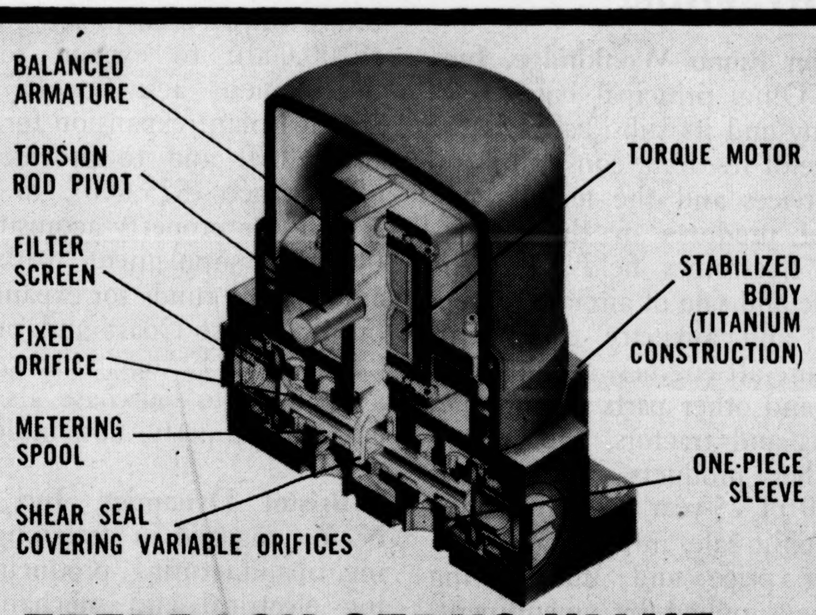
The National Cash Register Co., Dayton, Ohio, product improvement radio communication system AN/URC-15 (V, contract AF 33(600)-42187, dtd 26 Sept. 61, $1,452,686.

Continental Aviation and Engineering Corp., Toledo, Ohio, J69-T-29 engines, iaw/contractor's spec 2157C, dtd 18 Oct. 60, contract AF 33(600)-42426, dtd 18 Jan. 61, 213 ea., $3,298,305.

AiResearch Mfg. Co. of Arizona Div., The Garrett Corp., Phoenix, Ariz., starters, engine, gas turbine type STU-12/A34, contractor's model ATSC 100-1-4 P/N 350950, Aerno 42-8754, and maintenance data, (replenishment spares for F-105 B/D aircraft) contract AF 33(600)-42611, dtd 26 Jan. 61, 82 ea., $332,264.

Librascope Division, General Precision, Inc., Glendale, Calif., test equipment, spare parts and special tools, programing and field services, data and reports for: The Product Improvement of the Digital Camera Control System supplemental agreement No. 4 dtd 6 Jan. 61, to contract AF 33(600)-38550, $59,475.

Hamilton Standard Division, United Aircraft Corp., Windsor Locks, Conn., starters, pneumatic, aircraft engine, USAF Type M-5, Hamilton Standard Model PS 300-32, contractor's P/N 514418 starter and 515410 valve, Aerno 42-9405; spare parts, ground support equipment and data, (for support of B-58A aircraft installations, FY-61) contract AF 33(600)-42665, dtd 18 Jan. 61, 86 ea., $233,404.



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- Large, full opening, shear-seal orifices

This two-stage, four-way flow control valve is the only one available that provides true positional feedback without springs or levers. The first stage consists of an electrical torque motor and "shear-seal" orifice hydraulic amplifier, while the second or control stage is made up of an accurately matched spool and sleeve arrangement.

Hydromechanical unity feedback relates spool position to torque motor armature position and also nulls out effects of orifice variations due to supply pressure and temperature fluctuations. Flow force reactions are thus substantially reduced and hydraulic centering of pilot position is feasible without spring hysteresis and null shift. Large orifices prevent clogging and silting and high shear forces permit efficient operation even with highly contaminated fluids. Final null adjustments are made electrically by a balancing control at amplifier output stage.

TYPICAL CHARACTERISTICS

	Medium Flow (#6103-#6106)	High Flow (#6104)
Rated flow	to 7.5 gpm at 3000 psi valve pressure drop	to 18.0 gpm at 3000 psi valve pressure drop
Hysteresis	3% maximum total rated current	3% maximum total rated current
Supply pressure	300 to 3000 psi	300 to 4000 psi
Proof pressure	4500 psi pressure port 3000 psi return port	6000 psi pressure port 3000 psi return port
Pressure gain	First stage—500 psi per ma minimum with 3000 psi supply	First stage—500 psi per ma minimum with 3000 psi supply
Load pressure gain	8500 psi per ma minimum with 3000 psi supply	10,000 psi per ma minimum with 3000 psi supply
Temperature	−65°F to +275°F	−65°F to +275°F
Maximum Null Shift	(% of rated current)	
Temperature Change per 100°F	1%	1%
Supply Pressure Variation ±	2%	2%
Quiescent Current Change 20%	1%	1%
Weight	12 ounces	16 ounces

TORQUE MOTOR: Note: 6103 & 6106 Identical with exception of torque motor characteristics.

	Valve #6103	Valve #6106
Input Power	300 Milliwatts	64 Milliwatts
Rated Current	± 10 ma	± 8 ma
DC Coil Resistance (other motors also available)	3000 ohms/coil	1000 ohms/coil

Write for complete data

KEARFOTT DIVISION
GENERAL PRECISION, INC.
Little Falls, New Jersey

New Offerings

Thompson Ramo Wooldridge, Inc., Cleveland, Ohio; principal business of the company and its subsidiaries is the performance of research, consulting and advisory services and the manufacture and sale of products in the missile, space and electronics fields, and the manufacture and sale of aircraft component parts and auxiliary equipment, largely for aircraft engines, a wide range of engines and other parts for automobiles, trucks and tractors, and miscellaneous other products. Offering is $25,000,000 of 25-year debentures due 1986, for public sale; interest rate, public offering price and underwriting terms to be supplied by amendment. Proceeds will be added to the company's general funds; the company plans initially to reduce its presently outstanding V Loan borrowings by substantially the same amount.

Power Designs, Inc., Westbury, N. Y., engaged in the design, manufacture and sale of power supply equipment for the conversion of commercial a.c. power into precisely controlled voltages and currents necessary for accurate and reliable operation of complex electronic equipment. Offering is 500,000 shares of common stock for public sale at $2 per share; offering to be made on an all-or-none basis. Proceeds will be used to retire a bank loan ($100,000); to expand research and development activities ($50,000); for internal plant expansion for production ($100,000) and to provide additional office space ($25,000); to establish a reserve for property acquisition ($140,000); to supplement working capital and provide funds for expanded activity on the West Coast and possibly into Canada and Europe. The company has an option to purchase its plant and adjacent property, now under lease.

Bristol Dynamics, Inc., Brooklyn, N. Y., engaged in designing, engineering, manufacturing, producing, and selling electrical and mechanical assemblies, electronic and missile hardware components and systems, and special tools and fabrications. Offering is 100,000 shares of common stock, for public sale at $7 per share on an all or none basis; 70,000 shares are to be offered by the company, and 30,000 outstanding shares by Melvin D. Douglas, president. Of the proceeds from the company's sale of additional stock, $100,000 will be used to pay a bank loan; $100,000 to expand inventory and purchase raw materials; $100,000 to acquire new and larger facilities for the business; $50,000 for research and development; the balance for working capital.

Clifton Precision Products Co., Inc., Clifton Heights, Pa., engaged in the design, development, production and sale of synchros, instrument servomotors and certain servo-mechanisms for use primarily in aircraft and missiles. Offering is 60,000 outstanding shares of common stock, for public sale by the holder thereof, John P. Glass, company president; offering price and underwriting terms to be supplied by amendment. Glass owns 283,500 shares (67.9%) of the outstanding stock; sale of the 60,000 shares will reduce his interest to 53.5%.

Decitron Electronics Corp., New York, N. Y., engaged in designing, engineering, manufacturing and selling electronic equipment for the U.S. government. Offering is 50,000 shares of common stock for public sale at $2 per share; 30,000 shares are for sale by the company and 20,000 outstanding shares by the present holders thereof. Of the proceeds from the company's sale, $50,000 will be allocated to research and development, and the balance to general working capital.

Frontier Airlines, Inc., Denver, Colo., engaged in the transportation of passengers, property and mail; it serves 66 cities in 11 states. Offering is 250,000 outstanding shares of common stock for public sale by present holders thereof.

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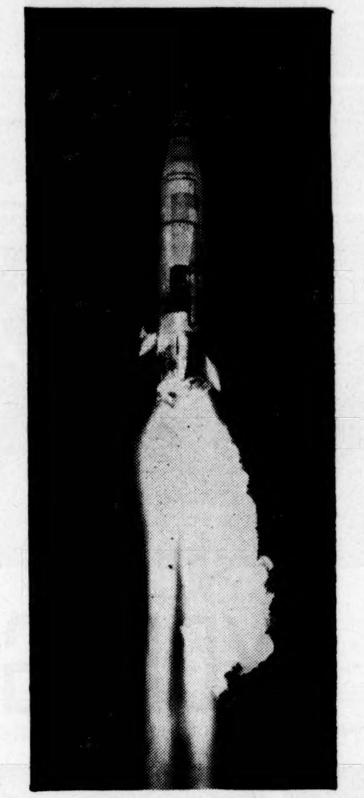

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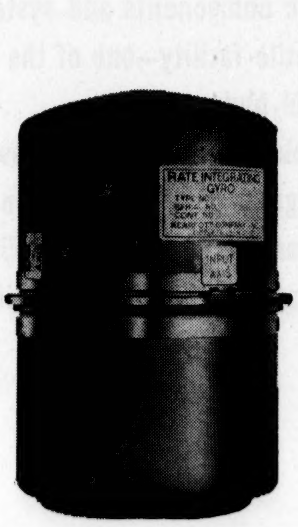
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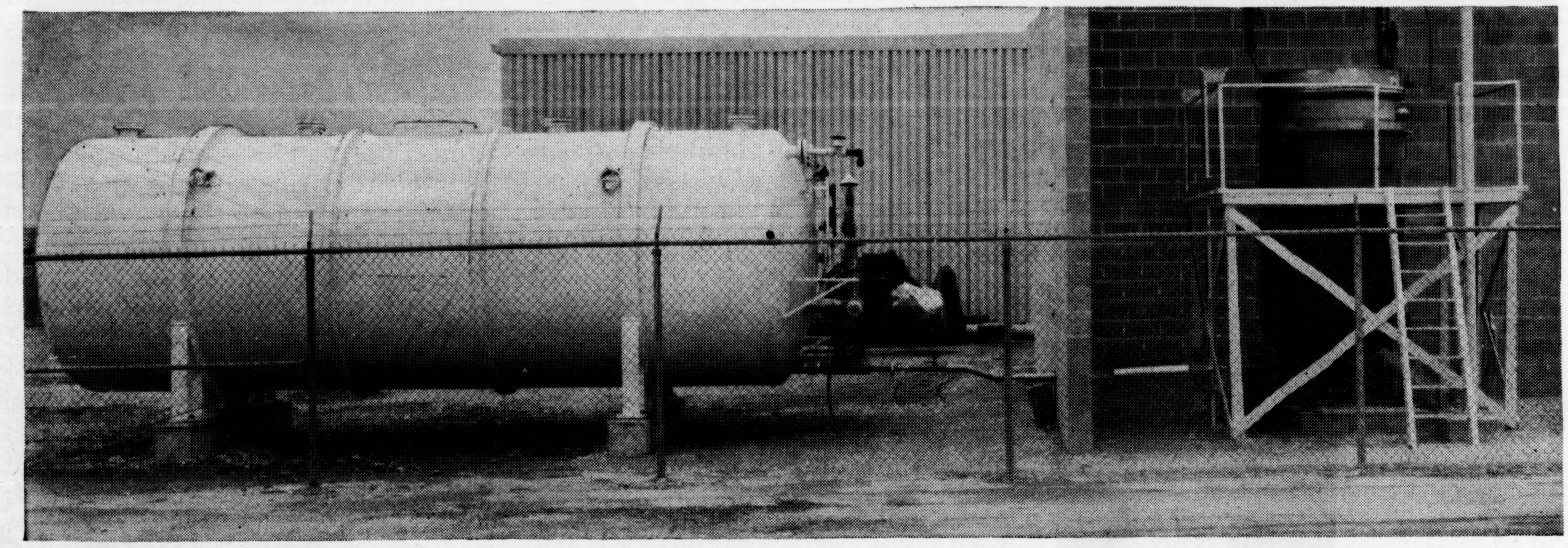
Other Divisions: GPL, Librascope, Link



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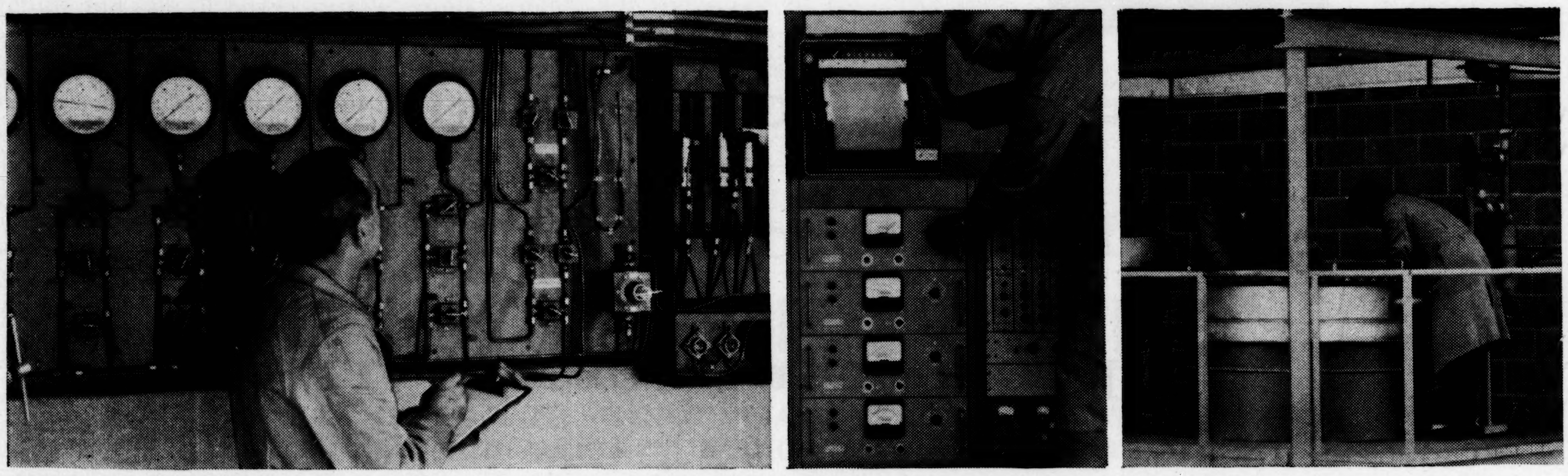

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The test chamber is a 500-gallon Dewar, 6-feet deep, 4-feet in diameter designed to accept components of the same size. The supply Dewar has a capacity of 5000 gallons.

The test Dewar may be used for either static or dynamic testing under cryogenic temperatures within a pressure range from 1 psia to 75 psia, made possible by incorporating 2000 cfm continuous vacuum pumping capacity into the system. This permits testing with a multitude of flow rates and pressure conditions simulating near "space" conditions. Complete instrumentation includes recording all parameters on a common time base.

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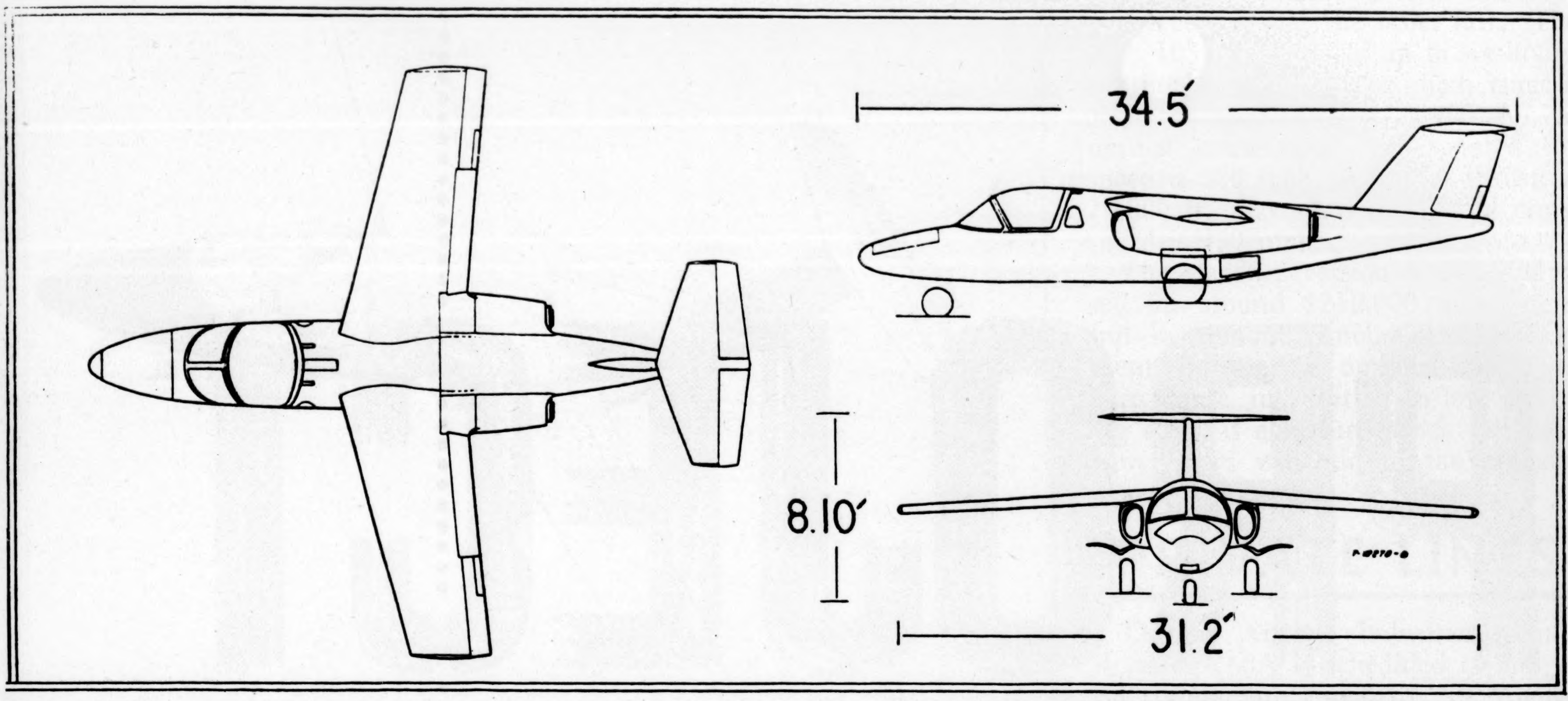

THREE-VIEW of Saab Aircraft Co.'s first prototype multi-purpose Saab 105 twin-jet aircraft scheduled to fly early in 1963.

Saab Reveals Entry in Twin-Jet Market

By Edith Walford

Geneva—Sweden's Saab Aircraft Co., with a long history as a designer and producer of military aircraft, plans to break into the multi-purpose, twin-jet, light-aircraft market by early 1963.

The Swedish company exhibited a model of its first prototype Saab 105, an all-metal, high-wing, four-to-five-seat jet transport, at the recent Paris International Air Show (AW June 19, p. 118).

The Saab 105 is a company-financed venture initially designed to meet Swedish air force requirements for an intermediate and advanced trainer. Saab hopes to make it a successful commercial venture as well. The Swedish air force will receive some of the first production units during 1963.

Capable of carrying 1,550 lb. of armament externally, the military version also can be used as a light ground attack aircraft. Other basic design studies include versions for liaison, business flying, reconnaissance, mapping and ambulance purposes.

The tricycle landing gear of the Saab 105 consists of a hydraulically steerable nosewheel which retracts forward into the fuselage and two main wheels which retract into the center fuselage section. It is fitted with single disk brakes, and an anti-skid warning device can be installed as an optional extra.

The wing is of stressed skin construction with two continuous spars. The inner space between the spars accommodates integral fuel tanks with a total content of 370 gal. The lower wing surface has six armament attachment points.

The fuselage is of light-metal, stressed-skin construction. The cabin is pressurized and located ahead of the wing in the forward fuselage section. Large, curved acrylic glass windows allow good forward and side vision and the canopy is operated by an electric actuator, but also can be opened manually. The standard military trainer version accommodates two passengers side-by-side in the cockpit, but two additional seats or a bench can be installed immediately behind the pilot's

Saab 105 Specifications

DIMENSIONS	
Wing span	31.2 ft.
Wing area	175 sq. ft.
Length	34.5 ft.
Height (from ground to top of fin)	8.1 ft.
Wheel track	6.7 ft.
Wheel base	12.9 ft.
Cabin width at elbow level:	
Front seat	4.08 ft.
Rear seat	4.2 ft.
WEIGHTS (military version)	
Empty weight including two pilots' seats	4,400 lb.
Equipped weight	4,675 lb.
Takeoff weight	6,609 lb.
PERFORMANCE	
Takeoff distance (50-ft. obstacle)	2,130 ft.
Landing distance (50-ft. obstacle)	3,180 ft.
Sea-level rate of climb (at takeoff thrust)	4,700 fpm.
On single engine	1,550 fpm.
Service ceiling (at maximum continuous thrust)	43,300 ft.
On single engine	25,000 ft.
Top speed (at takeoff thrust)	500 mph.
Maximum continuous cruise speed	450 mph.
Normal cruise speed	400 mph.
Stall speed	95 mph.
Range at normal cruise speed	1,450 mi.
Fuel capacity	370 U.S. gal.
POWERPLANT	
Two Turbomeca turbofan engines of 1,540 lb. thrust each.	

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THE FIRST SATELLITE RENDEZVOUS AND INSPECTION SYSTEM

. . . now underway at RCA Burlington

RCA has recently received the prime contract for the most complex satellite system yet created. The program is being carried out in the Boston area—at RCA's Burlington facility.

RCA will develop the complete final stage vehicle to inspect unidentified satellites.

For this challenging undertaking RCA requires top electronics men—men who can combine vast technical knowledge with creative imagination. Specifically, the need is for missile and electronics engineers, mathematicians, and physicists who can move ahead in any of the following technical fields:

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- **Reliability and Quality Assurance**

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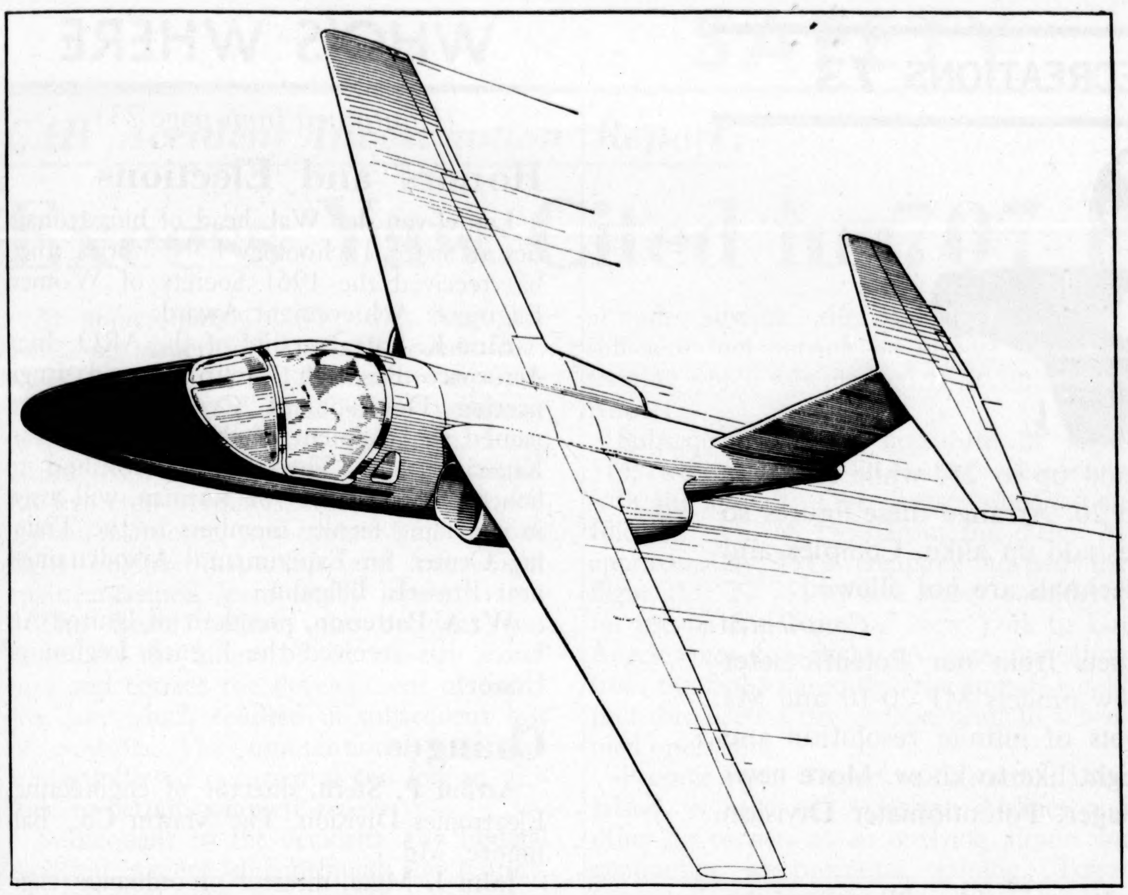
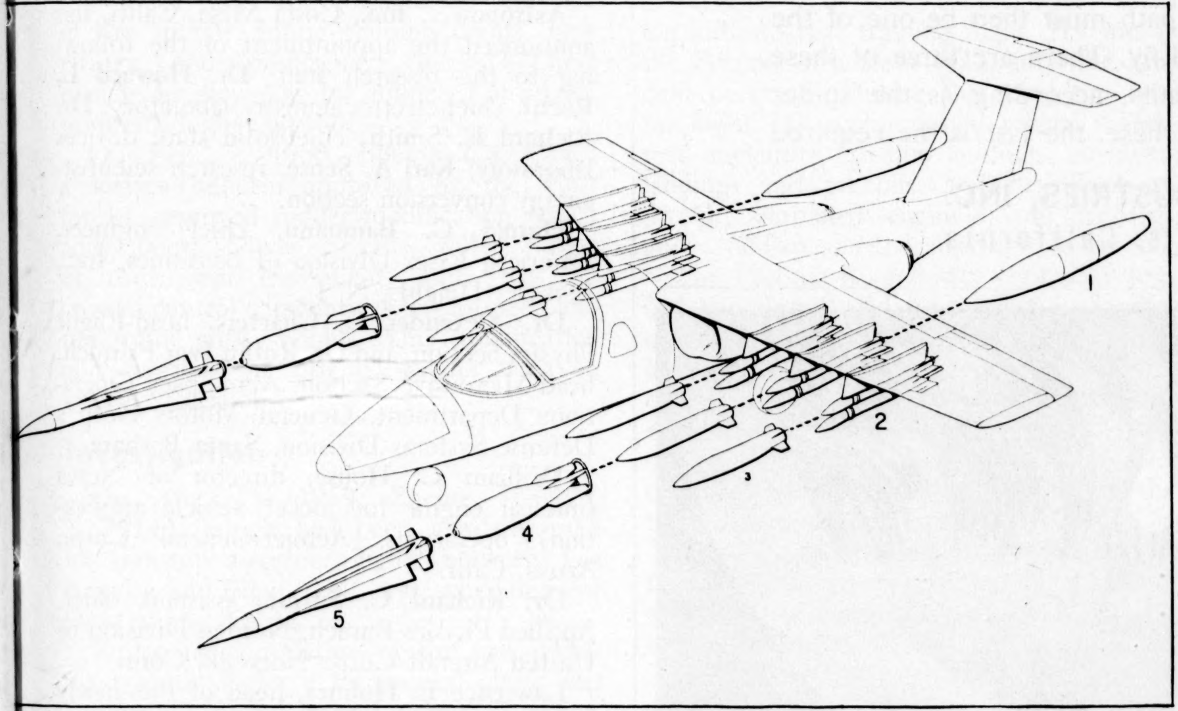


ALL-METAL, high-wing design is suitable for business/utility flying.



WITH EXTERNAL ARMAMENT, the Saab 105 can serve as light attack aircraft.

and co-pilot's seats to take two or three additional passengers.

For airline crew training purposes, the aircraft can be supplied with optional radio and/or full navigational equipment.

For ambulance or rescue duty, the right-hand seats can be removed to make room for a stretcher. The medical attendant then occupies the left-hand rear seat. When used for mapping or reconnaissance work, cameras can be installed in the fuselage floor or in under-wing pods, leaving ample room in the cabin for a crew of three.

As a light ground attack aircraft with a 1,550-lb. load of armament and sufficient fuel for a sea-level combat radius of 100 mi., takeoff and landing runs of the Saab 105 are about 2,000 ft. Maximum radius of action at sea level with the same load of armament and a reserve supply of fuel is approximately 250 mi.

The aircraft, which is controlled by a conventional stick in standard versions, can be fitted with a control wheel.

New Fan Engines

It will be powered by two new Turbomeca turbofan engines each rated at 1,540 lb thrust. The new engine is based upon the Turbomeca Bastan turboprop power unit. The major change in design, according to Saab, will be the installation of a front fan. The new engine currently is being developed by the French company and is scheduled for delivery to Saab by late 1962.

Engines are mounted underneath the wing section, one on either side of the fuselage. Power output of one of the engines is estimated to be sufficient for takeoff should the other fail. The Saab 105 is capable of up to six hours' continuous flight; its maximum range is given as approximately 1,450 mi. at normal cruise speed. Estimated top speed is 500 mph. at takeoff thrust; at 26,000 ft., maximum continuous cruise speed is 450 mph.

The standard version is expected to sell for around $210,000 including a full instrument panel. Radio equipment, however, is optional and extra. This figure, in addition to low operating costs, is a feature which the company hopes will add to the aircraft's general sales appeal.

PRIVATE LINES

Downer Aircraft Industries' refined Bellanca 260A is scheduled to roll off the production line early in August. Production of the last Bellanca 260 models is being phased out. Four 260As are scheduled for production in August, six in September, eight in October, with a level of 10 a month to be reached in November. Aircraft modification includes increased roominess, improved visibility, better ventilation and heating, new instrument panel arrangement, new design for both exterior and interior, and a cleaning-up of exterior surfaces and control surface mating.

Working agreement between Morane-Saulnier Aircraft Corp., France, and Coleton Aircraft Corp., Morton Grove, Ill., P.M. Coleman, president, for the assembly and distribution of the Rallye single-engine lightplane in the U.S. (AW Mar. 20, p. 96) has been terminated.

Avco Corp.'s Lycoming Div., Stratford, Conn. has completed the first test run of a new turboprop engine rated at 2,535 eshp. Engine, designated LTC4G-3, utilizes a split-power gear which transmits one-third of input power to the propeller shaft through the first stage reduction gear, while two-thirds are transmitted by the second stage reduction gear. Gear is integrated in the front of Lycoming's T55-L-5 engine. Weight, including gear system, is 795 lb.

Federal Aviation Agency is surveying medical and related emergency facilities of civil airports throughout the U. S. in line with its responsibilities to promote civil aviation and aviation safety. Areas to be reviewed by a four-man survey team will cover available manpower and hospital facilities at the airport as well as over-all medical facilities, and other health and welfare facilities for passengers, air crews and airport workers.

PROBLEMATICAL RECREATIONS 73

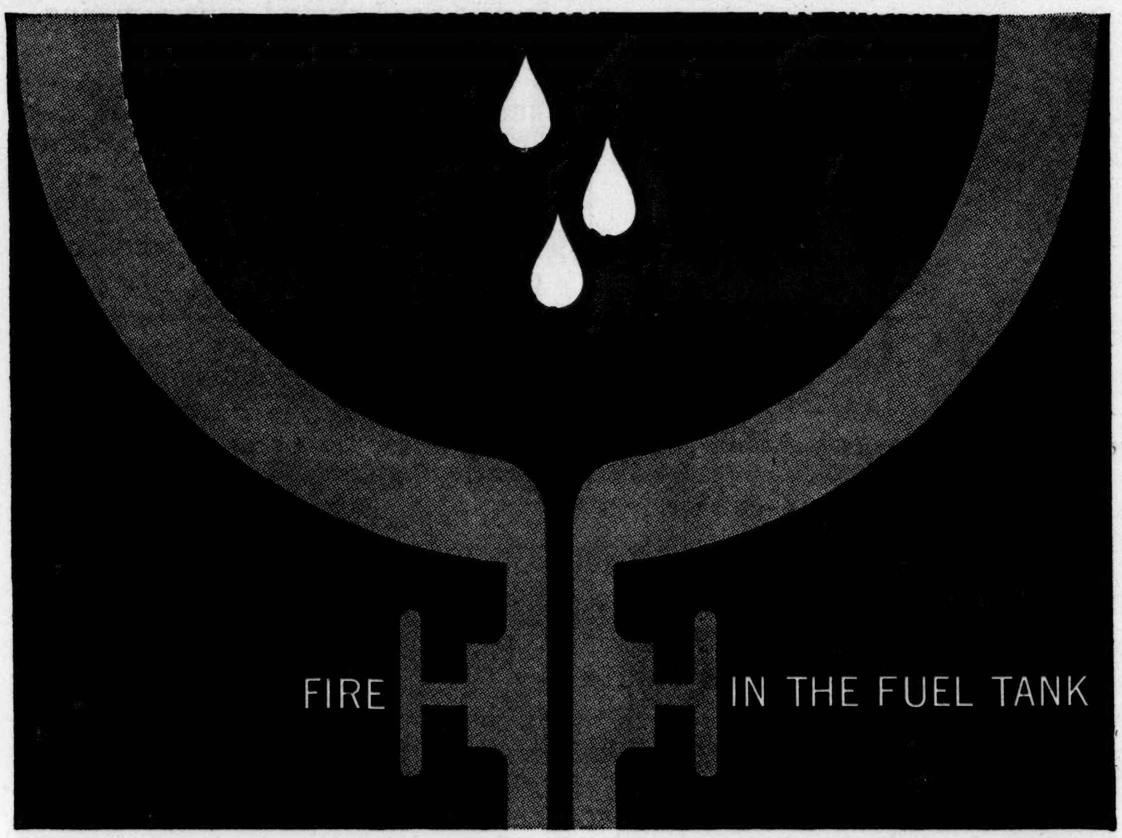
The odd digits 1, 3, 5, 7, and 9, add up to 25, while the even figures, 2, 4, 6, and 8, only add up 20. Arrange these figures so that the odd ones and the even ones add up alike. Complex and improper fractions and recurring decimals are not allowed.

—Contributed

Enumerating the number of products from our Potentiometer Division recently, we came upon new models MJ 20-10 and MJ 30-10, both precision multi-turn pots of infinite resolution and ±.005% linearity. Thought you might like to know. More news is available from: Marketing Manager, Potentiometer Division, Mt. Vernon, N.Y.

ANSWER TO LAST WEEK'S PROBLEM: Imagine the walls, etc. of the room to be made of cardboard rectangles, which are then "unfolded" into a plane. The shortest path must then be one of the straight lines joining the spider and fly. There are three of these, of length $\sqrt{26}$, $\sqrt{20}$, and $\sqrt{18}$ units, according as the spider crosses the 1, 2 or 3 unit edge; of these, the last is the required path.

LITTON INDUSTRIES, INC.
Beverly Hills, California



One of the many promising studies now being conducted by Lockheed/Georgia scientists involves injecting a hypergolic agent into a fuel tank—and using the gas resulting from the combustion to pressurize storable propellants. This program, under U. S. Air Force contract, is typical of the many advanced aerospace research activities currently in progress at the Georgia Division.

LOCKHEED/GEORGIA
Marietta, Georgia

WHO'S WHERE

(*Continued from page 23*)

Honors and Elections

Laurel van der Wal, head of bioastronautics at Space Technology Laboratories, Inc., has received the 1961 Society of Women Engineers Achievement Award.

Eino K. Latvala, chief of the ARO, Inc., Aerospace Research Group, Arnold Engineering Development Center, has been named the recipient of the first ARO von Karman grant. The grant, established to honor Dr. Theodore von Karman, will assist in providing faculty members to the Training Center for Experimental Aerodynamics near Brussels, Belgium.

W. A. Patterson, president of United Air Lines, has received the French Legion of Honor.

Changes

Arthur P. Stern, director of engineering, Electronics Division, The Martin Co., Baltimore, Md.

John I. Mika, director of ordnance engineering, Ordnance Operation, Avco's Electronics and Ordnance Division, Cincinnati.

Astropower, Inc., Costa Mesa, Calif., has announced the appointment of the following to the research staff: **Dr. Howard L. Recht,** chief-electrochemistry laboratory; **Dr. Richard E. Smith,** chief-solid state devices laboratory; **Karl A. Sense,** research scientist-energy conversion section.

Harold C. Baumann, chief engineer, American Essex Division of Nytronics, Inc., Berkeley Heights, N. J.

Dr. Alexander C. Charters, head-Flight Physics Section, and **Dr. Robin Ivor Primich,** head-Microwave Section, Aero-Space Operations Department, General Motors Corp.'s Defense Systems Division, Santa Barbara.

William C. House, director of Nerva (nuclear engine for rocket vehicle application) operations, Aerojet-General Corp., Azusa, Calif.

Dr. Richard C. Sirrine, assistant chief, Applied Physics Branch, Norden Division of United Aircraft Corp., Norwalk, Conn.

Lawrence L. Holmes, head of the newly formed Field Test and Evaluation Department for SAGE, The Mitre Corp., with facilities at Montgomery, Ala., and Ft. Walton Beach, Fla.

Matthew H. Portz, manager of public information, Aerospace Corp., Los Angeles.

Dr. T. Grant Maple, senior physicist, Research Division, Ampex Corp., Redwood City, Calif.

A. Wallace Schnitger, manager, Space Sciences Department, Consolidated Systems Corp., Monrovia, Calif.

Harley L. Bjelland, manager-engineering development, Military Department, The National Cash Register Co.'s Electronics Division, Hawthorne, Calif., and **John T. Lynch,** manager-marketing administration.

John A. White, assistant director of operations, Lockheed's California Division, Burbank, Calif.

Temco Aerosystems, division of Ling-Temco Electronics, Inc., Greenville, Tex., has named the following division directors: **Carl Bentley,** production; **W. A. Dolan,** administrative services; **D. L. Hearn,** engineering; **Jack Melton,** support services.

SAFETY

CAB Accident Investigation Report:

Excess Yaw Cited in 707 Peconic Crash

At approximately 1641 e.d.t., Aug. 15, 1959, an American Airlines Boeing 707, N 7514A, crashed and burned in an open field approximately three miles northeast of Peconic River Airport, Calverton, Long Island, New York, during a training flight. All five crew members, which included one captain-instructor, two captain-trainees, one flight engineer-instructor, and one flight engineer-trainee, were fatally injured.

The Board believes the accident was caused by the failure of the crew to recognize and correct the development of excessive yaw which resulted in subsequent loss of control. The unintentional maneuver which followed occurred at too low an altitude to permit complete recovery.

Subsequent to the accident, the Federal Aviation Agency discontinued the requirement that Boeing 707 aircraft make actual landings with simulated failure of 50% of the power units concentrated on one side of the aircraft during training flights, type ratings, and proficiency checks. These maneuvers may now be simulated at an appropriate higher altitude.

On Feb. 5, 1960, Boeing Co. issued a service bulletin approved by the FAA for an improved rudder modification which adds boost power to the wider ranges of directional movement, and gives increased control capability at low airspeed and minimum gross weight. This modification also replaces the original rudder with an improved version.

Investigation

On Aug. 15, 1959, Boeing 707-123, N 7514A, which had been regularly used for nonstop aircarrier flights between Los Angeles and New York, was scheduled for two training flights.

Following completion of the first morning training flight, a turnaround check was accomplished and several minor discrepancies were corrected. In order to bring the total fuel to 84,000 lb., 10,647 gal. were added. The engine oil and water tanks were serviced to the required capacities.

Jet transition training flight 514 was dispatched with Capt. Harry C. Job as captain-instructor, Capts. Fred W. Jeberjahn and William T. Swain as captain-trainees, Flight Engineer Arthur Anderson, flight engineer-instructor, and Flight Engineer Edgar Allen Freeman, flight engineer-trainee. At departure Capt. Jeberjahn occupied the captain's seat, Capt. Job occupied the first officer's seat, Capt. Swain was in the second officer's seat, Flight Engineer Freeman occupied the engineer's seat, and Flight Engineer Anderson was in the jump seat. The aircraft took off from Idlewild International Airport at 1340[1], with a gross weight of 201,410 lb. The VFR flight plan was direct to Fire Island, then V-16 to Peconic River Airport.

Training flight 514 accomplished high-altitude airwork after takeoff to permit sufficient fuel burnoff for airport transition training which was planned at Peconic River Airport.

Subsequent to the departure of flight 514, two company radio contacts were made with the aircraft. One contact obtained an Idlewild e.t.a. of 1830 from the crew. At approximately 1517 company advised the flight that N 7514A was being considered for use on trip No. 7, a New York to Los Angeles nonstop flight. A communication from the flight stated that the aircraft would probably need a tire change prior to scheduled operations.

Peconic River Airport at Calverton, Long Island, is used by American Airlines and other air carriers as an outlying airport for conducting jet transition training. Tower personnel are employed by the Grumman Aircraft Engineering Corporation.

Excerpts from the Peconic River tower log indicate that training flight 514 was in the Peconic area from 1511 until the accident occurred. During this time the crew for flight 514 accomplished several maneuvers, including full-stop landings, crosswind landings and takeoffs, a high off-set approach, simulated engine(s) out landings, and a no-flap aborted approach to landing.

The Peconic River tower controller testified the aircraft did not retract its landing gear following the last aborted approach to landing on Runway 23 but continued in the traffic pattern at an estimated altitude of from 1,000 to 1,100 ft. The crew reported on left base leg for Runway 23, was given clearance to land, and was informed that the wind was from 230 deg. at 10 to 15 kt. The last communication from the crew was the acknowledgement of landing clearance and wind information, at which time nothing of an unusual nature was reported.

Several eyewitnesses near the impact area were accustomed to the presence of Boeing 707 aircraft in the air over their homes or property. Immediately prior to the accident, a considerable number of these witnesses observed N 7514A and they were of the opinion that the aircraft was lower than usual, slower than usual, and making less noise than usual. Some witnesses observed smoke coming from the engines on one side of the aircraft prior to impact.

Eyewitnesses positioned along the landing pattern flight path observed the aircraft flying in a northerly direction on its downwind leg. N 7514A was observed to turn on the base leg to a northwesterly direction. At this time the aircraft was estimated by witnesses to be at various altitudes of from 600 to 1,000 ft. As it approached the extended centerline of Runway 23 it made a left bank, steepening to approximately 45 deg. The aircraft was then observed to recover immediately to level flight and to begin a bank to the right which became progressively steeper. The right bank continued until the aircraft was inverted, at which time the nose dropped and a yaw to the left was observed. N 7514A then continued to roll to the right in a nosedown configuration, variously described as from 30 deg. to vertical. The aircraft emerged from the right bank with the wings level, approximately 20 deg. to the left of the course from which the maneuver started.

Investigation revealed the aircraft struck the ground in a wings-level attitude, in a nearly stalled condition, yawed to the left approximately 12 deg., with considerable and nearly symmetrical power. The attitude was approximately 12 deg. nosedown but the angle of impact, which was the result of sink rate, was approximately 26 deg. A severe kerosene-fed fire followed impact. Weather at the time was good and not a factor in this accident.

One eyewitness, a private pilot, was flying a J-3 Cub airplane and was practicing takeoffs and landings from a small field located approximately one-half mile from the impact site. This witness testified that he was flying his airplane on a southbound heading at an altitude of approximately 300 ft. when he observed the Boeing 707 to his left at an estimated altitude of 600 ft. He observed the 707 start a shallow turn to the left (south) and estimated the separation between the two aircraft as approximately 800 to 1,000 ft. He testified that he did not feel concerned about the possibility that the two aircraft were on a collision course and believed no evasive maneuvers were required.

N 7514A crashed and burned in a nearly level potato field approximately three miles northeast of the Peconic River Airport. The wreckage area was confined to approximately the wing span of the aircraft in width and 1½ times the length of the aircraft, with a few components strewn in the direction of travel nearly 500 ft. from the point of initial impact.

The fuselage broke up into small sections at impact; the sections below the floorline were compressed front to rear and were shorn rearward. Nearly all of the fuselage sections forward of the rear passenger loading door were consumed by fire. No semblance of a recognizable cockpit or passenger cabin remained; the identifiable pieces from both were scattered throughout the wreckage area.

The wing outer panels broke off just inboard of the outboard nacelles and were partially consumed by fire. The inboard panels were broken into several sections with the upper skin sections receiving less heat damage than the lower sections.

The horizontal tail surfaces remained attached to the tail cone and received relatively little impact damage and no fire damage. The vertical fin and the rudder broke from the fuselage but were intact except for fire damage and secondary impact damage near the tip. Ground impact was along a direction of approximately 282 deg. magnetic.

Investigation also revealed the landing gear was fully extended and that all sec-

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[1] All times are Eastern Daylight based on the 24-hr. clock.

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what publication
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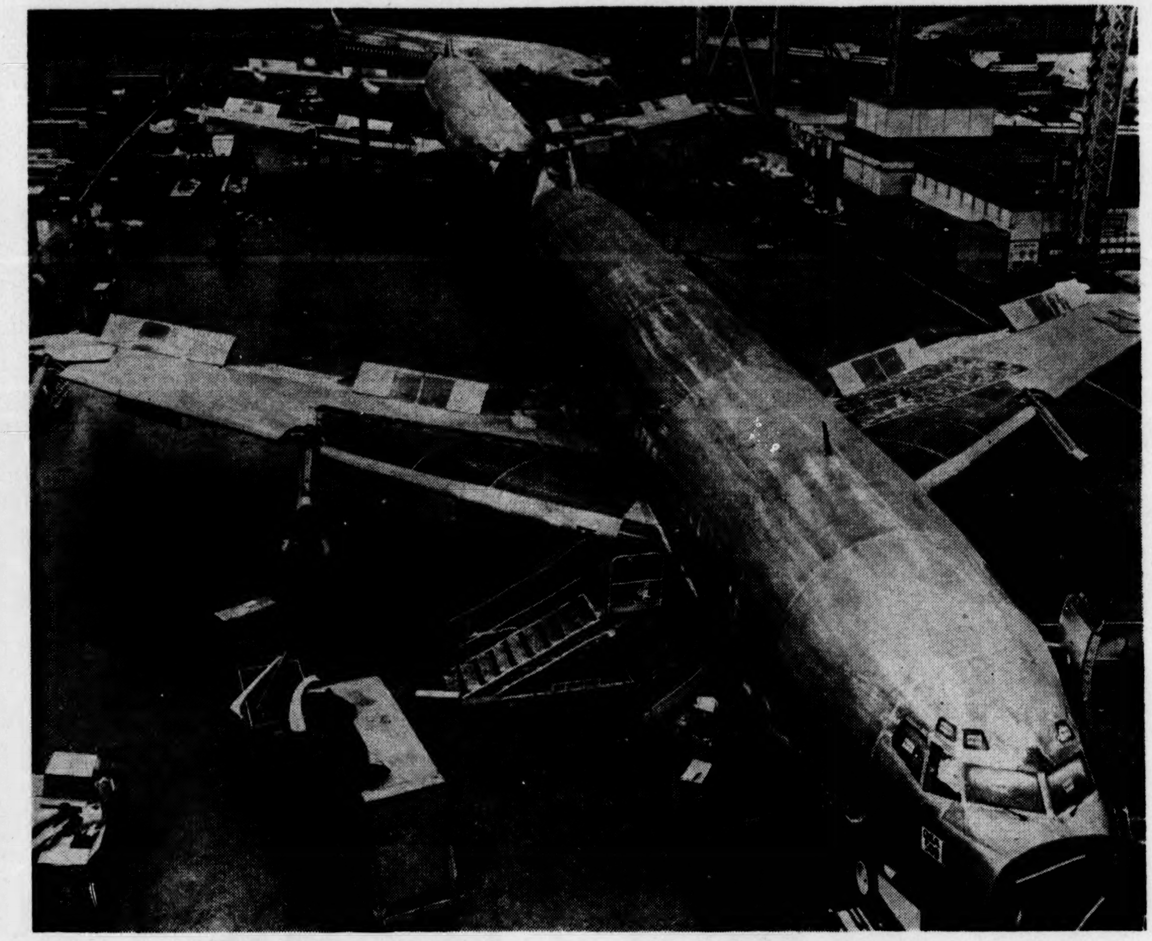

Boeing Builds Qantas 707-120Bs

Three Boeing 707-120Bs move down final assembly line in Renton, Wash. Qantas Empire Airways, Ltd., will take delivery by September.

tions of the wing flaps were extended 30 deg. at impact. The leading edge flap sections were found in the fully extended position. All flight control surfaces were accounted for in the wreckage but their positions at impact could not be established. The stabilizer was set at approximately 1⅔ units of noseup trim and the rudder and aileron trim spirals indicated approximately neutral trim at impact.

Flight Control Failure

Attempts were made to determine whether there had been a flight control failure prior to impact. Many components of the aircraft's flight control system between the flight control surfaces and the cockpit were so badly destroyed by impact and subsequent fire that their condition prior to impact could not be established. No indication of any pre-impact malfunction, failure, or unairworthy condition could be found in an examination of those flight control components that withstood impact and the subsequent fire.

The four Pratt & Whitney, Model JT3C-6, turbojet engines were found completely detached from their respective pylons. Nos. 1, 2, and 4 engines were found just forward of their initial point of contact and they were inclined, forward end up, about 30 deg. with their compressor ends resting on the forward edges of the engine impact holes.

These engines had rotated about their longitudinal axes in a clockwise direction by approximately the following amounts: No. 1, 15 deg.; No. 2, 80 deg.; No. 4, 45 deg. No. 3 engine lay upside down about 50 ft. ahead of the location of its initial ground contact. All fire damage to the engines occurred after impact. Except for No. 3 engine, which lay in a general ground-fire area, fire damage was localized and was caused by the spillage from broken fuel lines, fuel pumps, and fuel control.

The engines and accessories were shipped to the American Airlines shop at Tulsa, Okla., where they were disassembled. No evidence of operational failure or distress was revealed during the disassembly and examination. All engines were producing appreciable power at impact. Nos. 3 and 4 engines were more severely damaged by rotational interference than were Nos. 1 and 2. Engine instrument readings obtained were so variable that no pattern could be established; however, the oil temperature gage readings were No. 1, 105 deg. C.; No. 2, 105C.; No. 3, 70C.; and No. 4, 74C.

The hot sections of all engines were free of any evidence which would have indicated they had been subjected to over-temperatures. Bearings of all engines were normal except for damage resulting from impact loads and the drying effects of heat from the ground fire.

Maintenance records were reviewed; nothing of an unusual nature was found.

N 7514A was equipped with a Lockheed Aircraft Service, Inc., flight recorder in accordance with Sec. 40.208 of the Civil Air Regulations.[2] The record made by this instrument provides information enabling reconstruction of the complete flight path. The flight parameters are recorded by styli, which are mechanically linked to sensors and move vertically across a foil tape. As the aluminum alloy foil is fed past the recording styli, lines are embossed on the surface. One spool will accommodate approximately 100 ft. of foil, which allows approximately 150 hr. of recorder operating time.

The flight recorder installed in N 7514A was a model "C" recorder, Serial No. 107, and was certified as meeting Federal Aviation Agency Technical Standard Order C-51. It was severely damaged by crushing and fire; however, most of the recorder mechanism was functional.

The recorder was opened at the scene of the accident and a preliminary reading of the data was made by a Board employe. Subsequently, the entire flight recorder, including the foil, was taken to the manufacturer where a more detailed reading of flight data was accomplished with the use of precision equipment. Following this examination by the manufacturer the data tape was released by the Board to Boeing Co. for further study. The tape reduction data are analyzed under Analysis [below].

Flight tests were conducted subsequent to the accident wherein a light aircraft and a Boeing 707 participated in an exercise to determine whether or not the close proximity of the J-3 Cub aircraft would have required evasive action on the part of the 707 crew. The test was to duplicate conditions which occurred at the time of the accident. Four passes were made in which the small aircraft approached the 707 from the right on a collision course but slightly below the 707. The four passes were conducted as follows:

	707 altitude	J-3 Cub altitude
1st pass	1,000 ft.	400 ft.
2nd pass	800 ft.	400 ft.
3rd pass	600 ft.	300 ft.
4th pass	600 ft.	300 ft.

An experimental pilot for The Boeing Co. testified that should all control pressure be relaxed during an approach maneuver while simulating failure of 50% of the power units concentrated on the right side with landing gear extended and flaps 30 deg. extended, the Boeing 707 would yaw and roll to the right. Approximately five to seven seconds would be required to stop the roll before the aircraft reached a 90-deg. bank. Recovery could be accomplished by applying full opposite aileron and rudder and reducing power on all engines. During such a maneuver, the pilot stated, the aircraft could lose as much as 600 ft. of altitude.

Analysis

At the time of the accident, training flight 514 was accomplishing airport transition maneuvers at the Peconic River Airport. Following a no-flap aborted approach landing, the aircraft continued around in the traffic pattern with the main landing gear extended. Somewhere in the pattern the Nos. 3 and 4 engine thrust levers were retarded to simulate a multiple engine failure and Nos. 1 and 2 engines were advanced to sufficient power to maintain an indicated airspeed of approximately 160 kt.

Nearly full power would have been required on Nos. 1 and 2 engines to maintain altitude with gear down and flaps extended to 30 deg. The exact point at which power was reduced on Nos. 3 and 4 is debatable; however, since the oil temperature readings for these engines were determined to be 70 and 74C, respectively, it must be concluded that power was reduced early in the pattern, as evidenced by the engine cooling that occurred.

According to the tape reduction data, the downwind leg was made on a heading of approximately 55 deg.; speed was reduced from an indicated airspeed of approximately 200 kt. to 170 kt.; and altitude was decreased from approximately 1,850 ft. to 1,700 ft. During the turn to the base leg the aircraft descended from 1,700 ft. to approximately 1,100 ft. in the turn. The base leg was flown on a heading of approximately 305 deg., an indicated airspeed of approximately 165 kt., and an altitude of approximately 1,050 ft. Acceleration during the downwind and base leg was maintained at approximately 1g.

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[2] Sec. 40.208 reads: "A flight recorder which records time, airspeed, altitude, vertical acceleration, and heading shall be installed on all airplanes of more than 12,500 lbs. maximum certificated takeoff weight which are certificated for operations above 25,000 ft. altitude, and shall be operating continuously during flight."

Tape reduction data show that the first indications of other than normal flight began about 15 sec. before impact. At this time the aircraft was pushed over and rolled into a left bank. It was time to commence a left turn to the final approach and the increasing compass heading, due to gyro gimbal error, shows the roll which was also verified by witnesses.

At this point the aircraft yawed rapidly to the right. The yaw angle has been estimated as high as 17 deg., which is well beyond the 11- to 14-deg. angle that can be successfully controlled with full opposite use of the lateral control devices. The crew, for some unknown reason, failed to recognize and correct the development of this yaw and the aircraft continued to roll to the right.

When the aircraft passed the 90-deg. bank position, it was yawed right approximately 20 deg., resulting in approximately a 30-deg. nosedown attitude. The yaw was at its maximum angle and the roll rate had reached approximately 40 deg. per sec.

As the aircraft passed the inverted position the yaw angle was reduced considerably, indicating that some corrective action had been taken in the form of advancing the thrust levers on Nos. 3 and 4 engines and applying full left rudder and aileron. Positive acceleration was held at 1½ to 1¾g.

As the aircraft passed the 270-deg. roll position it was in a zero yaw condition. Acceleration was held at approximately 2g which is in the buffet range and is the tightest pullout that the aircraft could make. The power was then nearly symmetrical.

The aircraft struck the ground in a nearly wings-level attitude, yawed to the left approximately 12 deg., with considerable and nearly symmetrical power. The attitude was approximately 12 deg. nosedown but the angle of impact was approximately 26 deg., giving a floorline angle of attack of 14 deg. The yaw and nearly-stalled condition indicated on the flight recorder trace were verified by the ground impact marks at the crash site.

There was no control or actuator position by which power being produced at impact could be determined. The energy expended in halting rotation of the engines, as evidenced by the extent of damage from rotational interference, was the primary means of determining the approximate power at impact. Rotational damage indicated all engines were producing appreciable power at impact.

Unstacking of the N_1 compressors of Nos. 3 and 4 engines suggests slightly more power was being produced by these engines than Nos. 1 and 2. However, the readings of the four oil temperature gages indicated more power was being produced by Nos. 1 and 2 engines than by Nos. 3 and 4. This apparent conflict of factual evidence would be logical if, at the start of loss of control, while operating with Nos. 3 and 4 engines reduced to idle thrust their power levers were advanced quickly to the full-thrust position.

The higher power established by advancing the thrust levers would not be reflected on the oil temperature gages during the elapsed time to ground contact. In view of the relatively low altitude at which control was lost, it is concluded that this sequence of events occurred.

Additional Factor

Another factor in this accident was the delay in acceleration time of jet engines after thrust lever advancement. The delay in engine acceleration from idle to full power could be as high as six seconds. The Boeing Co. recommends that all thrust levers be retarded immediately in case of any out-of-control situation and thrust levers then be advanced on all engines together.

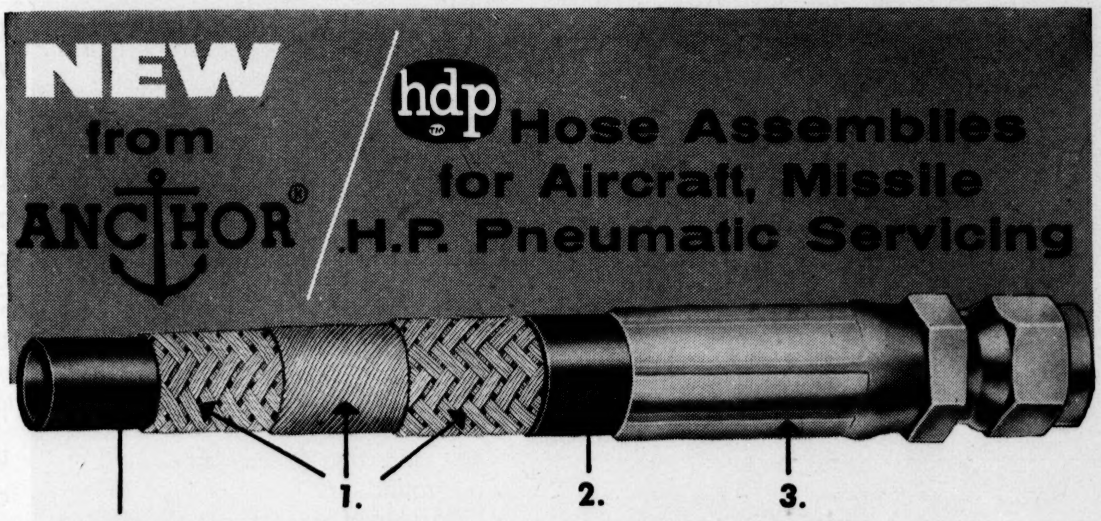
The rolling maneuver could have been stopped rapidly by reducing power to engines Nos. 1 and 2, since the yawing forces and the high unequal rudder forces would have been eliminated. However, even had this procedure been followed it is questionable whether sufficient altitude remained to effect complete recovery.

In the flight configuration that had been established, the asymmetrical power condition would tend to create yaw to the right and would require the application of opposite controls, particularly left rudder, to compensate for the unbalanced thrust.

The rudder characteristics of the Boeing 707 are such that when yaw angles in excess of approximately 10 deg. are attained, the rudder effectiveness deteriorates quite rapidly with a resultant loss of directional control. This can produce a dangerous flight condition. In order to minimize the probability of large yaw angles during flight with both engines on one side inoperative, directional control must be maintained with the rudder. Excessive aileron or bank angles should not be used to maintain directional control. Yaw angles of approximately 10 deg. require nearly full aileron control to maintain heading when inadequate rudder is applied. There is also a noticeable stiffening of rudder pedal forces during the last two or three degrees of rudder deflection. Therefore, the pilot must be certain to depress the rudder pedal fully whenever a maneuver requires full rudder deflection. It is extremely important that the employment of rudder be positive and properly timed.

It is apparent that roll due to yaw resulted either from a lack of application of sufficient rudder, or an inadvertent release of left rudder. Since there is a noticeable stiffening of rudder pedal forces during the last two or three degrees of rudder deflection, it is possible that in this maneuver, where full rudder was needed to make the turn to final approach with Nos. 3 and 4 engines at idle thrust, full left rudder was not utilized. If this were the case, a yaw of as much as or more than 10 deg. could be brought about as the aircraft was banked to the left. Such a yaw would produce a violent roll to the right due to the aerodynamic response of the aircraft to yaw.

The student might have released the controls after assuming the instructor was taking over to initiate evasive action following



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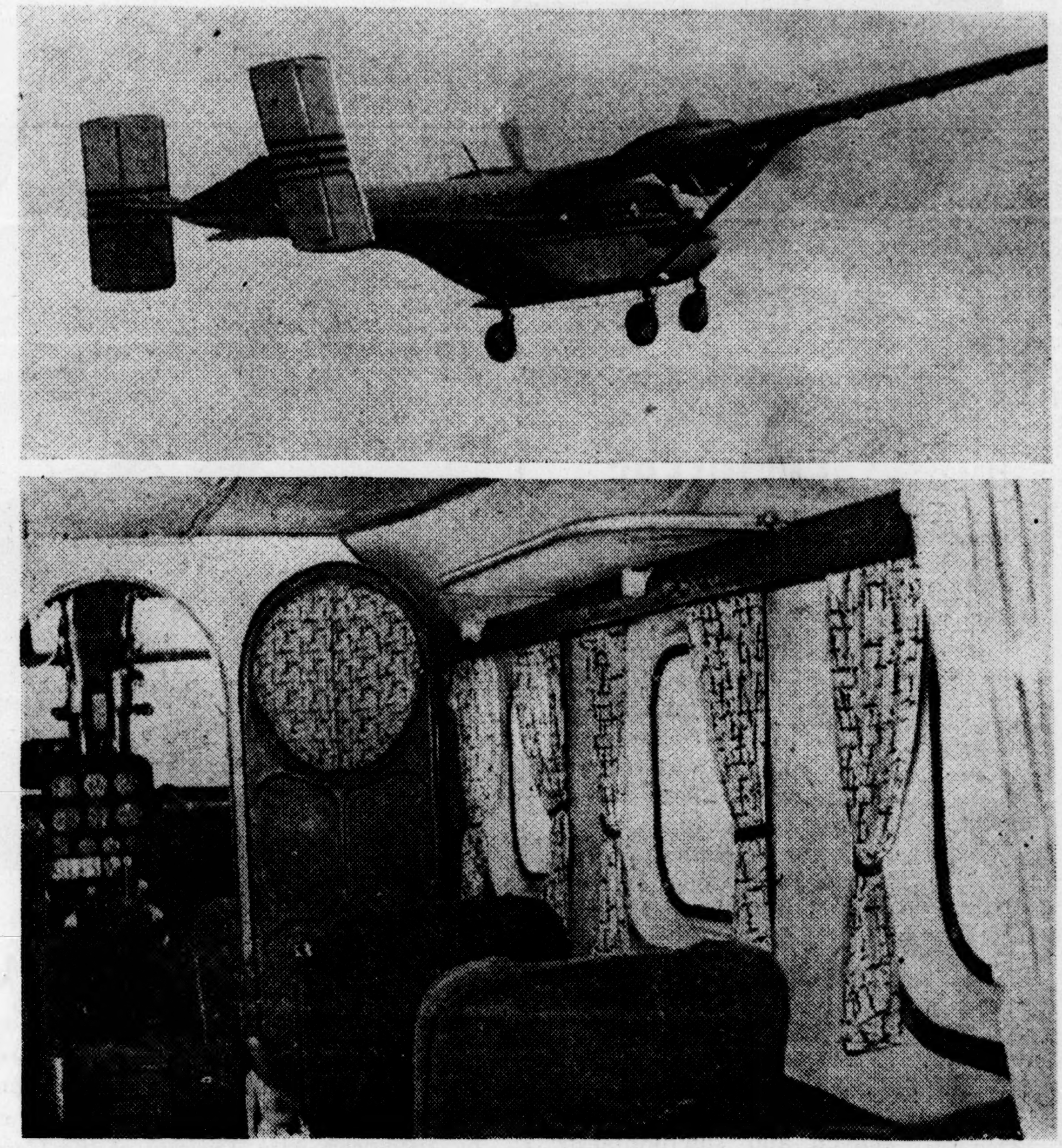


Russian An-14A Has Different Tail Than An-14

Tail assembly of the Russian Antonov An-14A Pchelka (Little Bee) light transport aircraft has been modified from the original An-14 (AW Apr. 21, 1958, p. 43) by addition of dihedral in horizontal tail surfaces and increased stabilizer area. Changes were probably made to improve tail effectiveness and give better engine-out performance. Seven-passenger Little Bee, recently exhibited at Moscow's Vnukovo Airport, can reportedly take off and land from 164-ft. long runways. It is still undergoing testing.

his observance of a light aircraft low and to the right of the Boeing 707's flight path. Subsequent flight tests have revealed that the light aircraft could have been an alarming factor and a possible cause for evasive action on the part of the Boeing 707 crew.

The instructor, sitting on the right side, could have indicated that evasive action should be taken and in the process of his taking control of the aircraft, the student relaxed rudder pressure before the instructor assumed control of the rudders. These circumstances pertaining to the presence of a light airplane are conceivable; however, certain points are difficult to resolve.

First, it is believed that a prudent instructor would keep ahead of the maneuver, especially in jet transition training and particularly in the type maneuver being conducted, and prevent the development of a critically unsafe condition. Secondly, the testimony given by a Boeing test pilot attested that evasive maneuvers could be accomplished successfully even though the aircraft was in an asymmetrical power condition.

Conclusions

After due consideration, the preponderance of evidence suggests the most logical fact for the loss of control was either the lack of application of sufficient rudder, or an inadvertent release of left rudder for some unknown reason. The delayed corrective action, together with the decision to advance power on the idled engines instead of reducing power on the good engines, permitted the yaw and induced roll to become severe and uncontrollable.

Subsequent to the accident, the FAA discontinued the requirement that Boeing 707 aircraft make actual landings with simulated failure of 50% of the power units concentrated on one side of the aircraft during training flights, type ratings, and proficiency checks. These maneuvers may be simulated at an appropriate higher altitude.

On Feb. 5, 1960, Boeing Co. issued a service bulletin approved by the FAA for an improved rudder modification, which adds boost power to the wider ranges of directional movement and gives increased control capability at low air speeds and minimum gross weights. This modification also replaces the original rudder with an improved version.

Although the Civil Air Regulations do not require a flight recorder to be operating during training, test, or ferry-flight operations of a scheduled air carrier aircraft, nevertheless, the flight recorder aboard N 7514A was operating during this training flight and considerable information concerning the maneuver and flight path information just prior to impact was obtained through reduction of pertinent data on the flight recorder tape.

Even though the recorder was severely damaged, considerable information was tabulated and graphed to assist the Board in determining a probable cause for the accident.

On Jan. 12, 1960, the Board recommended to the administrator, Federal Aviation Agency, that flight recorders be installed in an all new transport-type airplanes and presently operating turbine-powered transport-type airplanes. Subsequent to that date and as a result of the information gained from the flight recorder in this accident, the Board has expressed the opinion to the administrator, Federal Aviation Agency, that recorders should also be installed and operating during the training, test, and ferry-flight operations of these air carrier airplanes. It is the Board's belief that in these latter operations, the airplanes are subjected to the same environmental factor and flight loads experienced in scheduled service.

Probable Cause

The Board determines the probable cause of this accident was the crew's failure to recognize and correct the development of excessive yaw which caused an unintentional rolling maneuver at an altitude too low to permit complete recovery.

By the Civil Aeronautics Board:

ALAN S. BOYD
Chairman
ROBERT T. MURPHY
Vice Chairman
CHAN GURNEY
Member
G. JOSEPH MINETTI
Member
WHITNEY GILLILLAND
Member

SUPPLEMENTAL DATA

The Civil Aeronautics Board was notified of this accident at 1715, Aug. 15, 1959. An investigation was immediately initiated in accordance with the provisions of Title VII of the Federal Aviation Act of 1958. A public hearing was ordered by the Board and held in two phases. The operational phase of the investigation was held at the Henry Perkins Hotel, Riverhead, Long Island, New York, on Aug. 27, 1959. The technical phase of the investigation was held at the Forest Hills Inn, Forest Hills, Long Island, New York, Oct. 7, 1959.

Flight Personnel

Captain-Instructor Harry C. Job, age 45, was employed by American Airlines on Nov. 6, 1939. He was promoted to captain on Oct. 17, 1945, and to flight supervisor on Nov. 1, 1955. He held a valid FAA airline transport pilot certificate with ratings in Convair 240, DC-6, DC-7, and Boeing 707 aircraft. Capt. Job had a total of 18,000 flying hours as of Jan. 13, 1959. His latest first-class physical examination was taken Apr. 1, 1959. Capt. Job had completed the special Boeing 707 ground training courses and had over 210 hours in Boe-

New research and development opportunities for

ENGINEERS

The Columbus Division of North American Aviation is currently building a 120-ft. antenna system for MIT-Lincoln Laboratory under USAF sponsorship. This new antenna system, located near Tyngsboro, Mass., uses an advanced design which allows it to be tuned to exact pitch.

Extensive tests are being conducted to ensure that static and dynamic structural deflections of such antenna systems are kept to an absolute minimum to ensure the greatest possible system accuracy.

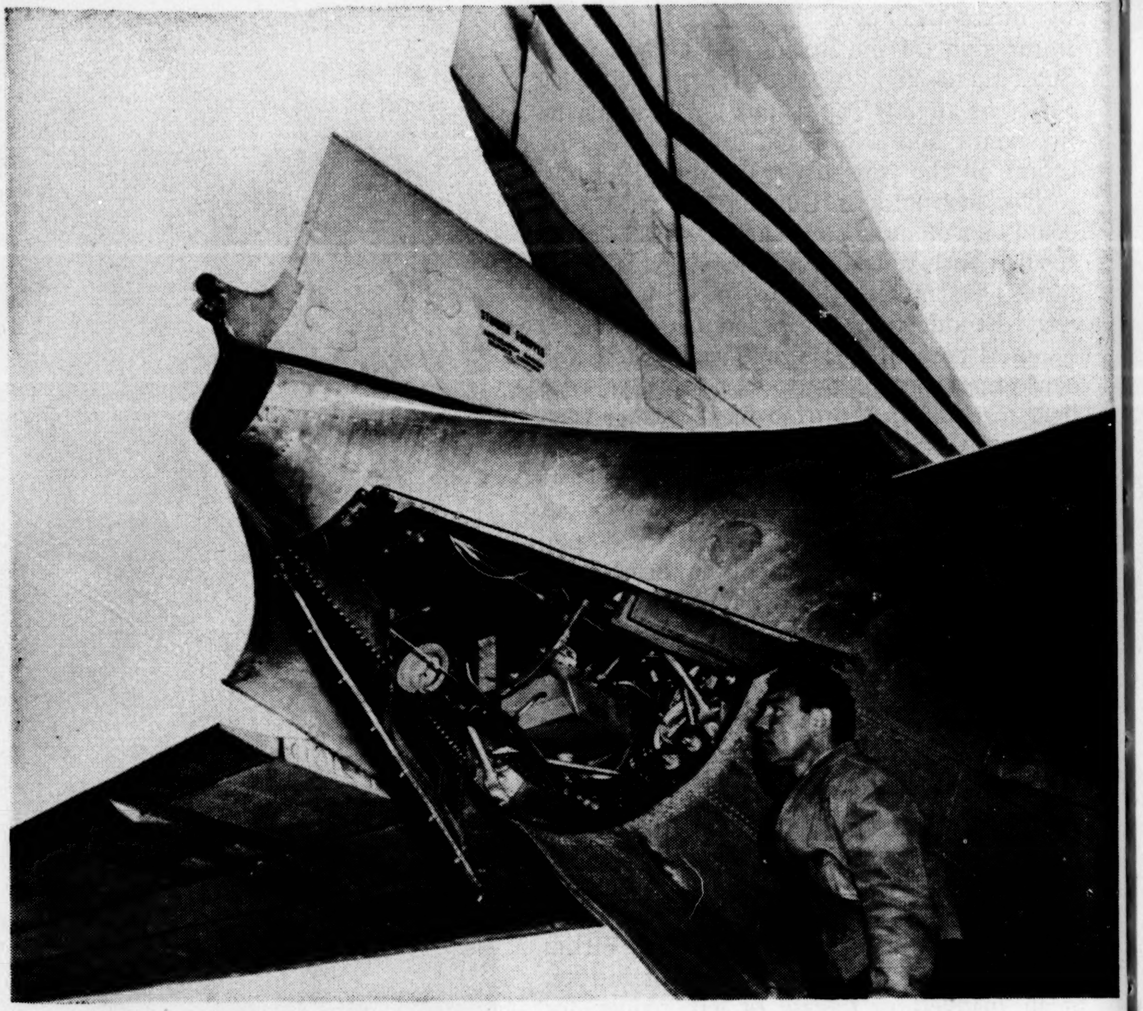
Engineers with advanced degrees interested in Research and Development directed to the prediction of deflection characteristics of such large ground based systems under static (inertial), dynamic (earthquake, winds), and thermal loads are required immediately.

Project Engineers are required to assume full responsibility for Design Engineering of these systems to meet extremely stringent deflection design requirements.

Please send your resume to:
North American Aviation
The Professional & Technical
Employment Office, Box AW 337
4300 East Fifth Avenue
Columbus 16, Ohio
Attn: Mr. H. Keever

All qualified applicants will receive consideration for employment without regard to race, creed, color or national origin.

COLUMBUS DIVISION
NORTH AMERICAN AVIATION



Auxiliary Power Unit Installed in 540s

Allegheny Airlines' Convair 540 turboprop aircraft will be independent of ground support equipment after installation of an auxiliary turbine in the tail. The unit provides pneumatic and electrical power for engine warmup, starting, ground air-conditioning or heating, and ground checkout of aircraft electrical systems. The power units are produced by AiResearch Mfg. Division of the Garrett Corp., Los Angeles, Calif., which first produced two similar units for Canadair 540 Napier-powered Convairs.

ing 707 aircraft, 188 hr. of which were as an instructor. Capt. Job had flown with approximately 30 students in the jet transition program.

Capt. William T. Swain, age 49, was employed by American Airlines on Sept. 8, 1936. He was promoted to captain on May 8, 1940. He held a valid FAA airline transport pilot certificate with ratings in Convair 240, DC-4, DC-6, and DC-7 aircraft. He had a total of 22,498 flying hours as of Feb. 28, 1959. His latest first-class physical examination was taken Feb. 28, 1959. Capt. Swain had completed the special Boeing 707 ground training courses, and accumulated 9:55 hr. pilot time, 14:52 hr. (training) observation time, and approximately 23 hr. (line) observation time in Boeing 707 aircraft, and had 16 hr. of Boeing 707 simulator time.

Capt. Fred W. Jeberjahn, age 50, was employed by American Airlines on Apr. 22, 1939. He was promoted to reserve captain on Oct. 28, 1941, and to captain on Mar. 28, 1946. He held a valid FAA airline transport pilot certificate with ratings in Convair, DC-4, DC-6, and DC-7 aircraft. He had a total of 20,175 flying hours. His latest first-class physical examination, taken June 23, 1959, included a waiver of lenses for near vision. He accomplished a company physical on July 11, 1959. Capt. Jeberjahn had completed the special Boeing 707 ground training courses, had accumulated 9:10 hr. pilot time, 29:18 (training) observation time, and approximately 25 hr. (line) observation time in Boeing 707 aircraft, and had 19:30 hr. of Boeing 707 simulator time.

Flight Engineer-Instructor Arthur Anderson, age 40, was employed by American Airlines on Feb. 26, 1940, as an apprentice mechanic. He was promoted to flight engineer on February 13, 1951, and to flight engineer-instructor on Mar. 10, 1951. He held a valid flight engineer certificate with ratings in DC-6, DC-7, and Boeing 707 aircraft. He had a total of 5,000 flying hours, 149:50 of which were in Boeing 707. He had over 164 hr. as a flight engineer-instructor. He completed his last FAA physical examination on Jan. 13, 1959. He had completed a special Boeing 707 ground training course consisting of 152:00 hr.

Flight Engineer Edgar Allen Freeman, age 36, was employed by American Airlines on Apr. 11, 1949, as a flight engineer. He held a valid FAA commercial pilot certificate with instrument rating, and a flight engineer certificate with ratings in DC-6 and DC-7 aircraft. He had over 10,200 flying hours as of May 29, 1959. His second-class physical examination was completed on May 29, 1959. He had completed the special Boeing 707 ground training course, had performed two periods of Boeing 707 training, and had accumulated a total of 7:30 hr. of Boeing 707 aircraft time. He also had 19:30 hr. of Boeing 707 simulator time.

N 7514A, a Boeing 707-123, serial number 17641, was manufactured June 5, 1959. It had approximately 736 hr. of flight time. The aircraft was equipped with four Pratt & Whitney turbojet, model JT3C-6 engines.

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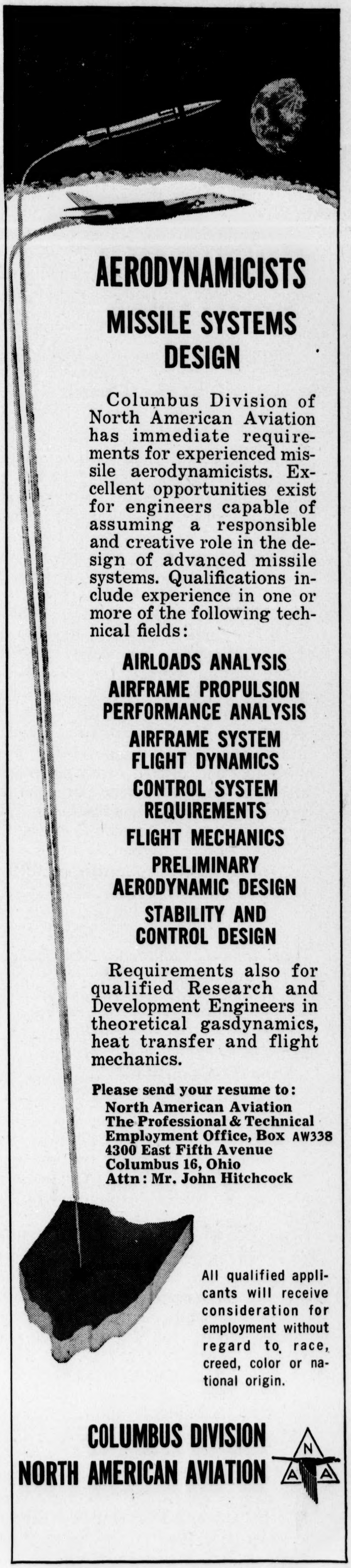

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COLUMBUS DIVISION
NORTH AMERICAN AVIATION

LETTERS

Paris Editorial

I would like to congratulate you for the wonderful editorial entitled New Image at Paris published in the 12 June 1961 issue of Aviation Week.

The philosophy you advance is certainly pertinent to our nation's world position in these perilous times. With a minimum of words you have brilliantly summed up the need for our rededication to the pioneer spirit our forefathers willed us.

Aerospace is truly our new frontier.

Thomas D. White
General, USAF
Chief of Staff

With great satisfaction we have read your editorial in Aviation Week (June 12) concerning the United States' participation in the International Air Show in Paris, France, this year.

The editorial supports other reports which have come from our embassy in Paris and other observers.

It should be noted, however, that the federal government's participation in this event would not have been nearly so effective without the substantial American industry representation. Government and industry combined to accomplish the U. S. objective.

You may be sure that your action in selecting the "New Image at Paris" as the subject for your editorial is very much appreciated here and by all who participated in the development of this project.

James G. Dunton
Director, Special Activities
Office of the Assistant Secretary of Defense
Washington, D. C.

The June 12 editorial "New Image at Paris" was also read on the U. S. Senate floor on June 20 by Sen. Ralph Yarborough (D.-Tex.) and inserted in the Congressional Record on June 14 and 15 by Reps. Jim Wright (D.-Tex.) and Emilio Q. Daddario (D.-Conn.)—Ed.

I have read with interest your editorial in the June 12 issue of Aviation Week and would like to commend you for an outstanding job on the Paris Air Show and something as hard to explain as the B-58 crash.

Since NAA was involved in the Bleriot Trophy Event, and we were on hand at the time of the show, we would like to run your editorial verbatim in the July issue of National Aeronautics Magazine as a guest editorial, giving full credit to you and Aviation Week.

Ralph V. Whitener
Office of the Executive Director
National Aeronautic Association
Washington, D. C.

Aviation Week welcomes the opinions of its readers on the issues raised in the magazine's editorial columns. Address letters to the Editor, Aviation Week, 330 W. 42nd St., New York 36, N. Y. Try to keep letters under 500 words and give a genuine identification. We will not print anonymous letters, but names of writers will be withheld on request.

I have followed, with a great deal of interest, your columns in Aviation Week, and I am pleased to say that your article in the issue dated June 12 was, without reservation, a propitious stride toward restoring the prestige of the United States from the inside-out.

Our only hope of regaining the number one position in the world today lies in the efforts of the American public, more specifically in the ability of men like yourself to carry our light high to a world darkened by the ever increasing breadth of the "Red Velvet Curtain."

Frank A. Weiss, Jr.
Arkansas City, Kan.

Couldn't resist writing you on the excellent editorial (June 12). I only wish everyone, both in and out of the defense business, could be made to read it.

G. Jackson Butterbaugh
Assistant Director
Public Relations
Bell Helicopter Co.
Fort Worth, Tex.

Let me add my name to what surely must be a large list of people in the industry congratulating you on your current editorial (June 12).

W. G. McGarry
General Electric Co.
Evendale, Ohio

I think your June 12 editorial was really fine. . . .

After reading for so long of our national shortcomings and list of "lasts" in the grimmest race in our history, it contains a badly needed note of hope for the future.

That this hope exists, I am morally and literally certain, is due in no small measure to the many fine editorials you have written in the past which have pointed a blunt and eloquent finger at our dismal failures and their cause, and a directional finger at the path out of the morass and away from the abyss.

Chet Spurgeon
National Aircraft Noise Abatement Council
Washington, D. C.

Control of Space

Reference Mr. Francis J. Muller's letter "Space for Peace" in your June 12 issue (p. 134). I have no quarrel with his basic message, however, it is—in my opinion—an oversimplification of the major problem facing the free world today. His analogy of diverting attention from a dangerous task to one of more interest and little danger, i.e., let's not focus our attention on ICBMs, atomic bombs, etc., but rather look at the peaceful applications of space, is rather like the two-headed coin. I remember a youthful experience that taught me a lesson I'm not likely to forget. Another boy and I were engaged in a quarrel but physical violence had not yet come to pass (possibly because I was a year or two older). Suddenly my opponent mentioned that my shoes were untied and when I looked down—POW! My point here is that by simply diverting our maximum effort to peaceful applications and in cooperation with our potential enemies, we might find ourselves looking at our shoelaces at the wrong time.

We must recognize our enemy for what he is and what he represents. I believe that we have enjoyed peace thus far because we, the United States, have been able to enforce the peace.

I could not agree more with Mr. Muller that space offers great potential for peaceful application and exploration. But I must take exception when he states there is no worry about who owns space when we get there. There are many of us who believe who "owns" space may be the most critical question to be answered in the history of the world. My personal conviction is that if a potential enemy "owns" space before we get there we might not get there at all, even for peaceful exploration. Control of access always has been the prominent factor in determining what nation was number one in world power. England had her sea power and controlled access to the ports of the world. The United States proved that air power could dominate and control national power.

The trend for the future is apparent—space offers untold opportunities to control access, and the nation that "owns" space will certainly be in the dominant position to control world power. We know what our actions towards other nations would be if we controlled the vast area of space. The important thing is we should not underestimate what our enemy's actions would be if he controlled space.

A new national slogan might be "Space Is for Peaceful Purposes, and Aerospace Power Is for the Preservation of the Peace."

William K. Callam
Springfield, Va.

Semiconductor Survey

I wish to compliment you on Barry Miller's article entitled "Semiconductor Crisis Looms Over Pricing" that appeared in the June 12 issue of Aviation Week (p. 73).

Mr. Miller's writing reveals quite accurate insight into the present economic and strategic aspects of the semiconductor industry. As evidence to the article's reception among our semiconductor personnel, let me state that this has become the most reproduced and highly circulated article of any that has caught the attention of our personnel at this Philco installation.

Stephen E. Madeline
Public Relations
Philco Corporation
Lansdale Division
Lansdale, Pa.